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ABSTRACT

This teaching package presents information and materials for use by special and industrial arts educators in teaching learning-disabled students. It may also be of use to guidance counselors and administrators for student counseling and placement. The package is comprised of two primary units. Unit 1 overviews the field of learning disabilities to familiarize industrial arts instructors with the nature and needs of special students. It includes student characteristics, related vocabulary, descriptions of diagnostic tests, role of the secondary learning disability resource room teacher, classroom strategies, hints for cooperation between special and vocational instructors, and sample forms. The second unit provides the special education resource teacher with an overview of and information related to six industrial arts areas: drafting, electricity, graphic arts, metalworking, power mechanics, and woodworking. The format for each shop area includes brief introduction, general goals, areas covered, safety procedures, texts and supplements with readability level indicated, key word vocabulary list with definitions, tools, equipment and machines, outline of math skills, math pretest, related teaching aids, list of related occupational opportunities, and skills checklist. Appendixes include lists of additional selected resources and trade schools in Connecticut. (YLB)

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A PARALLEL TEACHING PACKAGE FOR
SPECIAL EDUCATION/INDUSTRIAL ARTS

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INTRODUCTION

The increasing influx of identified special students at the secondary level, has resulted in a concern for today's educators to become familiar with the educational needs of these students. This package is designed primarily to assist industrial arts and special educators to meet the needs of the learning disabled students in the industrial arts area.

It represents an attempt to organize available information and materials that can be utilized by the Special Education and the Industrial Arts Departments, in order that they may work cooperatively in teaching students with learning disabilities.

The content of this parallel teaching package may also be of use to guidance counselors and administrators for student counseling and placement.

This package is comprised of two primary units. The first unit provides a brief overview of the field of learning disabilities. The second unit is concerned with information associated with industrial arts. The learning disabilities section is intended to provide industrial arts instructors with an introduction to the broad area of learning disabilities. The industrial arts section is designed to provide the special education resource instructor with an overview of, and information related to six industrial arts areas. It is hoped that this information can be used by the special educator in the resource room and to serve as a vehicle to increase communication between the areas of special education and industrial arts.

It is our hope that the implementation of this parallel teaching package will help to clarify the nature and needs of the learning disabled student and provide the information necessary for a successful learning experience for these students in industrial arts.

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INTRODUCTION

LEARNING DISABILITIES UNIT

The purpose of the material in this unit is to familiarize classroom instructors, guidance counselors and administrators with the nature and needs of the special student.

This unit includes characteristics of the learning disabled student, related vocabulary, descriptions of diagnostic tests, and strategies for the classroom teacher. It also includes the role of the secondary LD teacher and helpful hints for a cohesive effort between special educators and industrial arts instructors in meeting the needs of special students.

The unit concludes with samples of forms; (1. IEP, 2. Student Progress Report, and 3. Student Profile Sheet). It is important that the classroom teacher, counselors and administrators are familiar with these forms, as their imput can contribute to a successful program for special students.

1. IEP - statement of recommendations for students individualized educational program developed by members of a PPT. (See chapters on PPT - IEP)

2. Student Profile Sheet - a brief description of the learning disabled student's strengths and weaknesses. These forms are filled out by the special teacher and are distributed to teachers that work with those special students. They should be kept confidential.

3. Student Progress Report - filled out by the classroom teacher several times a year indicating student's progress to the LD teacher.

WHAT IS A LEARNING DISABILITY?

As a teacher, you may find several types of "exceptional" students in addition to the "norm" in your classroom.

It is important that we do not confuse the learning disabled student with other exceptionalities and with the "slow" learner. The definition of Learning Disabilities, according to the National Advisory Committee on Handicapped Children (1968) as cited in Lerner's Text (1976, p. 9) is as follows:

> "Children with special learning disabilities exhibit a disorder in one or more of the basic psychological processes involved in understanding or using spoken or written language. These may be manifested in disorders of listening, thinking, talking, reading, writing, spelling, or arithmetic. They include conditions which have been referred to as perceptual handicaps, brain injuries, minimal brain dysfunction, dyslexia, developmental aphasia. They do not include learning problems which are due primarily to visual, hearing, or motor handicaps, to mental retardation, emotional disturbance, or to environmental disadvantage."

In an effort to clearly understand what a learning disability is, it is essential to distinguish this category from:

1. MENTAL RETARDATION (EMR - Educable Mentally Retarded) Consistent low intellectual ability, falling in the retarded range of intelligence.

Learning Disabled students have average intelligence or potential, however, there is a discrepancy between their potential and achievement. LD students do well in some areas and very poorly in others.

2. VISION AND HEARING DEFECTS - acuity impairment

A learning disability is not caused by acuity defects in vision or hearing. The LD student can receive information accurately but the brain has difficulty in processing what is seen or heard.

3. EMOTIONAL AND SOCIALLY MALADJUSTMENT - emotional disturbance or behavior disorders

A learning disability is not primarily caused by emotional and social maladjustment; these are two separate areas, however, an LD student may display emotional overtones that result from repeated failure and mounting frustration.

4. ENVIRONMENTALLY DISADVANTAGED - culturally deprived

Learning Disability students come from all backgrounds: low, middle, and upper-class families. Children from sound, stimulating environments may still have difficulties reading, speaking, etc.

5. PHYSICALLY HANDICAPPED - physical disabilities

A learning disability student is disabled educationally not physically.

Most important, one must not confuse the difference between the learning disabled student and the slow learner. Remember, most LD students have average intelligence or potential. They are not slow!

The slow learner has:

1. a low ability level - below average intelligence

2. low achievement level - learning rate corresponds to ability level

3. exhibits a "flat profile" in diagnostic testing or academically all areas low

The Learning Disabled student has:

1. average intelligence or potential

2. low achievement in certain areas - discrepancy between learning rate and ability level

3. exhibits a "scattered profile" in diagnostic testing and academically, many "peaks and valleys" - high and low areas

Although an LD student can receive information properly, the brain has difficulty processing what is seen, heard, or felt. This disorder in the central nervous system interferes with basic learning functions of collecting (organizing), sorting (discrimination), storing (memory), and expressing information.

These disturbances result in modality weaknesses: auditory visual or kinesthetic (motor) which hinder the development in the academic areas.

Myklebust (1967) states: "the psychology of learning is disturbed because of an impairment in the central nervous system. Because of a neurological deficit, the learning process of these students is different".

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Therefore, various methods of instruction - multisensory in adapting the curriculum can be successful in teaching these students.

LEARNING DISABILITIES GLOSSARY

The following terms may be helpful in understanding the problems of the Learning Disabled Student. The definitions have been adapted from Janet Lerner's text, and from several lectures in Special Education at CCSC.

* AUDITORY PERCEPTION - the ability to interpret or organize data received through the ear.

** AUDITORY DISCRIMINATION - a process under the category of perception. The ability to discern likenesses and differences between sounds.

Behaviors: does not hear differences in sound, cannot reproduce sound, confuses letters and words.

** AUDITORY MEMORY - a process under the category of perception. The ability to store and recall material through auditory input.

Behaviors: difficulty remembering sounds, difficulty remembering material presented orally, difficulty in following directions.

** DIRECTIONALITY - the relationship of an object or point in space to another object or point in space, (right-left, up-down, forward-backward, etc.).

Behaviors: difficulty in this skill may result in left right confusion in reading and writing.

* DYSCALCULIA - lack of ability to perform mathematical functions, usually associated with neurological dysfunction or brain damage.

* DYSGRAPHIA - extremely poor handwriting or the inability to perform the motor movements required for handwriting; often

associated with a neurological dysfunction.

* DYSLEXIA - a disorder of children who, despite conventional classroom experience fail to attain the skills of reading. The term is frequently used when neurological dysfunction is suspected as the cause of the reading disability.

* EXPRESSIVE LANGUAGE - skills required to produce language for communication with other individuals. Speaking and writing are expressive language skills.

Behaviors: difficulty with speech sounds, difficulty formulating words and sentences (verbal and written), difficulty with grammar and syntax (verbal and written), inadequate oral vocabulary.

** EYE-HAND COORDINATION - the ability to coordinate vision with movements of the hand.

Behaviors: difficulty in handwriting, copying or drawing what is seen, tracing, completing, or reproducing forms, cutting.

** FINE MOTOR SKILLS - the ability to control fine muscular movements as in the hand.

Behaviors: difficulty with writing, prefers to print, difficulty assembling parts of mechanisms, holds a paper at unusual angles.

** GROSS MOTOR SKILLS - ability to move and control various parts of the body - total musculature.

Behaviors: difficulty with body movements, poor in athletics and physical education.

** KINESTHETIC - motor movements of the body including gross and fine motor skills.

** MODALITY - avenues of sensory input to include auditory (ear) visual (eye) tactual-kinesthetic (touch-motor) olfactory (smell) and gustatory (taste).

** MULTI-SENSORY APPROACH - the utilization of many modalities simultaneously in teaching. The student will see, hear, and touch at the same time when presented with a particular task.

* PERSEVERATION - the tendency to continue an activity once it has been started and to be able to stop or modify the activity even though it is inappropriate.

Behaviors: does not stop reading or writing at an indicated point, repeats words or sentences consistently when speaking or writing. May repeat previous responses on tests.

* READABILITY LEVEL - an indication of the difficulty of reading material in terms of grade level at which it might be expected to be read successfully.

* RECEPTIVE LANGUAGE - language that is spoken or written by others and received by the individual. These skills include listening and reading. The student can hear what is said but cannot comprehend what is said.

Behaviors: difficulty comprehending concrete and abstract words, poor reading comprehension, difficulty following directions, listening critically and making judgements.

** SPATIAL ORIENTATION - the ability to organize space in terms of the individual relating his physical self to the environment with reference to distance, size, position, and direction.

Behaviors: clumsy and awkward, turns in messy work, unorganized work habits, confuses concepts up, down, front, back, over, under, etc.

** SEQUENCING - the ability to remember in order that which has been heard, seen, or felt for both long and short periods of time.

Behaviors: may change order, omit items or backtrack, uneven level of work from day to day and between subjects, inability to carry out directions properly.

* VISUAL PERCEPTION - the ability to interpret or organize data received through the eye.

** VISUAL DISCRIMINATION - a process under the category of perception. The ability to discern likenesses and differences between symbols.

Behaviors: letter reversal in reading and writing, confuses letters and words, cannot reproduce symbols correctly.

** VISUAL MEMORY - a process under the category of perception. The ability to store and recall material through visual input.

Behaviors: difficulty remembering words seen or structural parts of words, difficulty remembering material in written form, or remembering what is read.

* VISUAL FIGURE GROUND - the ability to attend to one aspect of the visual field while perceiving it in relation to the rest of the field.

Behaviors: difficulty perceiving foreground and background.

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* cited from Lerner

** cited from lectures at CCSC

EMOTIONAL AND BEHAVIORAL PERFORMANCE

The following performances were taken from the following text: What About Me? The LD Adolescent by Doreen Kronick, Academic Therapy Publication; page 170, California (1975).

1. ANGRY, DEFIANT, and TENSE: makes derogatory remarks about peers and teachers; is sullen or explosive; overacts; unable to enter debate or discussion, loses temper, calls names; uses strong language; refuses to work refuses to cooperate; refuses to take tests; refuses to read aloud or write compositions; is easily provoked; provokes, taunts, and dares; resistant to suggestions; makes unnecessary errors during oral reading resulting from tension.
2. EMBARRASSED: refuses to read aloud, or to have anything he's written read aloud; refuses to bring books home; refuses to enter discussions; doesn't want anyone to see his work; complains of the level of the materials and the work.
3. FRUSTRATED: tears up paper or marks it up, rather than correct the errors; hates to get low marks; cannot cope with competition; seeks attention by performing in non-academic ways - may be class clown; dislikes to repeat anything he has said or done.
4. VULNERABLE: makes excuses for inability to perform or accomplish; tries to hide feelings and reactions; is afraid to make errors; antisocial - refuses to "buddy up"; does not like to be touched, or wants excessive body contact.
5. UNCERTAIN: resists change; is afraid to try something new; will follow the lead of others; will change allegiances to follow group.

6. MOODY: uneven behavior; feelings and reactions--often goes from a peak to a trough; extreme enthusiasm changes to disinterest; can go through several mood changes in one day.

7. EASILY DISTRACTED: looks at other students; is disturbed by sound, movement, interruptions; loses his place when reading; forgets what he was about to say or do.

8. HYPERACTIVE: taps floor, desk; wiggles, jumps up and down; leaves his seat; perpetual motion--will write or draw on anything available, including his own body or the person nearest to him; may have a spell of incessant talking, laughing, or making sounds.

9. IMPULSIVE: speaks out when others are speaking; may walk out of the classroom, either saying nothing or mumbling; will suddenly stop working, or do work other than what class is doing; disrupts class with witticisms or behavior; starts and stops activities on the spur of the moment.

10. POOR SELF-IMAGE and FEELINGS OF DEFEAT: may call himself a "dummy"--often accepts the role; considers himself "bad" or different; associates with younger children or those in a lower grade; won't plan ahead--feels there's no place for him to go; refuses to believe he can succeed at anything--may feel he can succeed only verbally.

11. DISORGANIZED: frequently late or absent--doesn't wake up on time; forgets homework, books, equipment; neglects homework, or does it incompletely; undisciplined; forgets special activities such as trips, even though planned; leaves money at home; forgets to bring lunch.

12. IMMATURE: uses inappropriate responses; has unrealistic goals; interrupts others; enjoys getting others in trouble; wants all the attention; wants the teacher to himself; whines and complains about minor things; does not know how to handle money; sulks; allows others to use him; cannot function socially with his peers.

PPT

(PLANNING AND PLACEMENT TEAM)

The purpose of this team is to ensure that each student needing special educational services is identified and provided for. The involvement of a PPT begins when a student has been referred for assessment (by teacher, parent, etc.) and continues until the student is no longer in need of services.

The planning and placement team may be comprised of an administrator, school psychologist, guidance counselor, social worker, parents, classroom teachers, special education personnel, outside specialists, and when appropriate, the student himself.

At the high school level the PPT exists to carry out the following responsibilities:

1. to formulate an adequate individualized educational program (IEP) for each exceptional student.

2. to recommend an appropriate and least restrictive placement for the student (regular class, resource room, self contained special class, or private placement).

3. to monitor and review the student's IEP and when appropriate, modify or change the student's program or placement.

IEP

(INDIVIDUALIZED EDUCATIONAL PROGRAM)

The IEP is a written statement of the student's individualized program. It should be written in concise educational terms, understandable to parents and designed to assist the instructional personnel in selecting and utilizing appropriate educational materials and strategies. Recommended changes in the IEP must be done at the PPT. This includes modifying a students' current program with the special resource teachers, discontinuing service, or placement in another learning environment.

Each IEP is reviewed at least annually by the PPT. It is important that the IEP is an educational program developed jointly, but it is not a binding contract. The goals specified in the IEP are projected outcomes - not guarentees of achievement.

According to section 10-76d-11 of the Connecticut General Statutes, the IEP includes:

1. a statement of students' present level of functioning (academic and social)

2. statement of annual goals

3. statement of short term objectives

4. statement of specific educational services needed - LD, Speech, etc.

5. a description of extent to which the student will participate in the regular educational program

6. list of people responsible for IEP

7. objective criteria, evaluation procedures and schedules for determining achievement of goals

DESCRIPTION OF DIAGNOSTIC TESTS

Intellectual Tests

1. Wechsler Intelligence Scale for Children - Revised (WISC-R)
   I.Q. test for children 5 to 16 years of age. Measures strength and weaknesses in areas of expressive language as well as receptive language, visual-motor coordination, perceptual organization, and memory.

2. Stanford-Binet Intelligence Scale
   Intelligence Test for children 2-18 years of age.

Modality Tests

1. Slingerland Screening Tests (for identifying Children with Specific Learning Disability)
   There are four appropriate forms of this test:
   - Form A for Grade 1 and Grade 2
   - Form B for Grade 2 and Grade 3
   - Form C for Grade 3 and Grade 4
   - Form D for Grade 5 and Grade 6

   It is designed to assess information processing skills in the tested child for the purposes of screening and diagnosis. There are eight subtests at each level which assess various means of visual and auditory processing. The visual tests require the child to copy a paragraph from a distance and at near point; to remember a stimulus (a word) and to reproduce it in writing. Reversals (b-d), inversions (n-u), transpositions (play-paly), and omissions are noted. The auditory tests are required to have the child repeat words and/or a short story dictated to him/her, as well as to indicate sounds heard at the beginning and end of words.

2. Detroit Tests of Learning Aptitude (Harry Baker, B. Leland)

The tests yield a general mental age as well as a series of mental ages for each subtest ranked from lowest to highest. This can be used for preschoolers through high school age. There are 19 subtests; usually 9-13 are given to a child. It is designed to tap strengths and weaknesses in learning style.

	AREAS TESTED	SUBTESTS
1)	Reasoning and Comprehension	1,2,8,10,15,17
2)	Practical Judgement	5,7,10
3)	Verbal Ability	2,3,11,19
4)	Time and Space Relationships	10,12
5)	Number Ability	7, 14
6)	Auditory Attentive Ability	6, 7, 13, 18
7)	Visual Attentive Ability	1,3,9,12,16,17,18
8)	Motor Ability	5, 7, 12, 18

3. Developmental Test of Visual-Motor Integration (Berry)

Measures Visual-Motor coordination. The space in which each design can be copied is provided immediately below the design.

Achievement Tests

1. Peabody Individual Achievement Test

This is a wide range screening test designed to survey a student's level of achievement in the basic skills of knowledge. It includes math, reading recognition, reading comprehension, spelling, and general information. Scores can be plotted on a profile sheet so the identification of significant differences can be easily seen. This test is appropriate for kindergarten through the adult level.

2. Key Math Diagnostic Arithmetic Test

This is an individualized test which provides a diagnostic assessment of math skills. Items are arranged in order of increasing difficulty. It provides a grade equivalent based on the total performance, as well as, a diagnostic profile showing the child's performance in the 14 skill areas. This test is appropriate for preschool through sixth grade.

3. Wide Range Achievement Test (J.F. Jastak, S.R. Jastak) WRAT

The WRAT tests reading (word recognition and pronunciation), written spelling, and arithmetic computation. Subtests are divided into two levels; Level 1 is used between ages 5-12; Level 2 is intended for persons 12 years to adult. It helps to determine instructional levels, and to diagnose disabilities in reading, spelling, and arithmetic.

4. Woodcock - Reading Mastery Test

The Woodcock is an individualized test that provides a diagnostic assessment of reading skills. The test measures reading growth or achievement with independent, instructional and frustration levels. The five measured ares are: letter identification, word identification, word attack, word comprehension, and passage comprehension. The scores yield grade equivalents and percentile ranks. The test is available in forms A and B for pre and post testing and is appropriate for grades K-12.

Projective Tests

1. Human Figure Drawing

Drawing by child providing developmental, neurological, as well as emotional indicators.

2. Kinetic Family Drawing

Offers child's perception of role within his family and of relationship with its members.

3. Sentence Completion Test

Deals with particular concerns of child, especially ones he/she is able to express.

4. Thematic Apperception Test (TAT)

Consists of twenty pictures,majority of which depict people. Subject develops story around what has and is about to happen as well as the feelings of the people involved.

ROLE OF THE HIGH SCHOOL

LEARNING DISABILITY RESOURCE ROOM TEACHER

Two learning disability teachers are assigned to each of the three high schools in the city of Waterbury. The instruction provided is primarily remedial and a diagnostic prescriptive approach is used. Assessment of each student's area of weakness is followed by programming to help the student with his problem areas of learning. Small groups of students are serviced directly, and other LD students' programs are monitored (with no direct service) depending on PPT recommendations (work study students etc.). The actual number of students serviced should not exceed 20 per resource teacher unless circumstances (approved by supervisor) allows it.

The learning disabilities program is supported by remedial teachers in the content areas (English, Math, Science, Social Studies), school psychologist, school social worker, the guidance counselor, speech, language and hearing pathologist and administrator. A special reading tutor is also provided through Special Services to assist the LD teachers in remediation for severe reading disabilities.

The role of the High School Resource Room teacher as designated in the Remedial/Learning Disabilities Program, approved by the Board of Education for the City of Waterbury, is as follows:

1. To offer resource room services on a scheduled basis to identified LD students.
   a. remediation of learning disability problems
   b. tutorial remediation, if necessary, using learning materials designed for the student's type of diagnosed deficit

   c. administering academic tests orally or in untimed situations if designated in the IEP

   d. learning disability screening as per PPT decision

2. To team teach on a scheduled basis with content subject area teachers of remedial English, Math, Science and Social Studies.

3. To monitor progress of those LD students who are not receiving direct services.

4. To be involved in all PPT meetings at assigned school which involves learning disability students or other students assigned to the resource room.

5. To be responsible for planning, implementing, and administering all aspects of the students IEP including pre and post testing requirements.

6. To conduct educational screening of those students recommended by the PPT.

7. To act as a liason person between PPT and regular staff.

8. To advise regular staff of remedial techniques and materials when appropriate.

9. To be available on request, for parent conferences.

10. To be responsible for written progress reports and other pertinent materials upon request by the supervisor, principal or PPT.

STRATEGIES IN TEACHING
THE LD STUDENT IN THE REGULAR CLASSROOM

The following strategies by Hartley as cited in Parrish (1980, p. 257) and by Chase (1976, pp. 26-31) may be helpful in approaching the learning disabled student.

General Strategies:

1. Avoid putting a student in a failing or embarrassing position (reading out loud if he has reading problems, writing on board if his handwriting is poor, etc.).

2. Give all students the right to choose some alternate assignments. That way the learning disabled student does not stand out.

3. Use teacher comments on papers (in printed form); give clues to strengths and provide direction for the future.

4. Allow group efforts.

5. Allow a buddy system.

6. Give a variety of assignments throughout the term so that there is something that all students can excell in.

7. Ask student to do work just beyond his present level of achievement.

8. Offer step by step guidance through the work by personal instructions, precise written instructions, or taped instructions.

9. Allow revisions in testing.

10. Encourage student's participation in setting his own goals.

Presenting Materials and Assignments:

1. Materials should be presented in both oral and written form. Use as many methods as possible; films, overheads, illustrations, etc. (All handouts should be clearly printed - no worn out dittos!)

2. Materials should go from simple to complex. It may be necessary to review and repeat more than you first thought necessary.

3. Be very well organized in presenting materials. LD students have difficulty with organizing material - use outlines whenever possible.

4. Keep assignments short and in manageable parts. The LD student should be expected to do classwork but with modifications of quantity not quality.

5. Offer opportunities for student to ask questions about assignments.

6. Give only one assignment at a time so that the student does not become confused.

7. Speak clearly and slowly, putting key words on the board, especially if the student is expected to take notes.

SPECIFIC TECHNIQUES FOR COMMON PROBLEMS

(Hartley as cited in Parrish, pp. 257-58)

(1980)

If the problem is reading and the student is expected to learn content:

1. Use films or film strips.
2. Provide records, tape recorders.
3. Allow use of pictures, films, cassettes.
4. Refer to texts or books in large print or simplified reading level.
5. Encourage students to seek help from other students.
6. Cut the amount to be read, i.e. select key passages or chapters

If the learner has problems with listening:

1. Provide printed directions to accompany oral presentations.
2. Give students tapes so he may follow directions at his own pace or listen to them over and over.
3. Provide individual help to be sure directions are understood.
4. Allow help from another student.

If the problem is one of poor writing:

1. Allow taping of reports or tests.
2. Encourage use of typewriter, even for taking tests.
3. Offer opportunities to build models.
4. Provide opportunities for oral reporting and testing.
5. Require short samples of written work carefully and excellently done.

6. When testing, correct written work for concepts, not for area of disability (spelling, writing, etc.)
7. Allow student to have help in editing written reports prepared outside class. Stress should be on excellence in what is turned in, even if it is one paragraph, one neat page.

If the problem is one of poor math concepts:

1. Have student verbalize the problem step by step to make sure he understands each stage.
2. Check to see that the meaning of key symbols is clear (+, -, etc.)
3. List steps of a process on study sheet or tape; allow student to refer to it as he works.
4. Help the student to group words according to their meaning.
5. Emphasize the position of numbers and symbols when it is important to computation.
6. Cut concepts into smaller steps than is done in most texts.
7. Allow students with spatial problems time to work out spatial relationships, as in geometry, at their own pace.

TIPS ON TESTING IN THE CLASSROOM

1. Review material to be covered for tests - provide outlines for students or LD teacher to follow on material or terms.
2. Oral testing, if needed, by classroom teacher or LD teacher.
3. Give extra time for the LD student in taking tests.
4. Use concise multiple choice questions or matching format on tests.
5. For essay format - allow student to dictate answers to LD teacher, another student or teacher, or tape essay.

TIPS ON GRADING

"Grades can be a prime motivational factor for some students, but really frightening and tense for others. No student wants to fail and it is our job to see that we do not put students in a failing position." (Chase, 1976, pp. 22-23) The grades in classes should reflect the progress the student has made at his or her instructional level. Their grades should not be penalized because they are already working below grade level. It is important to note "the learning disabled student has been programmed to fail and has had more than his share of failure throughout the grades no matter how hard he tried." (Chase, 1976, p. 23)

Chase further states: "Grading Need Not Represent A Compromise In Your Standards." (Chase, 1976, p. 25) As instruction should be geared to the students' strengths and weaknesses, several areas can be considered for the students' grade, such as - Attendance, Attitude, Participation, Homework, Tests (oral or written), Extra Credit Work, etc.

Remember - grade on improvement, LD students shouldn't be compared to others - they must be graded on individual progress.

TEN WAYS IN WHICH SPECIAL AND VOCATIONAL INSTRUCTORS CAN WORK TOGETHER

1. Communicate on and mutually consider scheduling of handicapped youngsters into vocational programs.
2. Jointly select materials for purchase to supplement handicapped students in regular vocational programs.
3. Schedule meetings on handicapped youngsters (IEP staffings, etc.) based upon cooperative convenience.
4. Allow for handicapped students to explore vocational programs prior to actual enrollment, and proceed in programs at an individual pace.
5. Increase vocational instructor's awareness of the handicapped through:
    - A. mini workshops
    - B. successful placements
    - C. using successful vocational teachers as teacher trainers
6. Increase special education instructor's awareness of regular vocational program content.
7. Share instructional materials and equipment.
8. Joint availability of special education to vocational education on a non-restrictive basis.
9. Share student's instructional strengths and weaknesses.
10. Assist each other in placement for student once saleable skill (s) has been mastered.

LEARNING DISABILITY RESOURCE ROOM

RE: Information Sheet

Learning Disability Student

Student: ____________________ Year _________

Approximate Reading Level: _________

Comments:

Approximate Math Level: ________

Comments:

Perceptual Problems:

Specific Learning Disability:

Social/Emotional Behavior:

Physical or Health Problems:

PPT Recommendations:

Guidance Counselor ________________________

Additional Comments:

Please contact us for further information concerning this student. We appreciate your cooperation in observing the student's strengths and weaknesses in an effort that we may carry out his program effectively.

Thank you,
The LD teachers
Room # _____

STUDENT PROGRESS REPORT

Learning Disability Resource Room
Room # ________

Student's Name: ______________________________ Date ____________
Subject ______________________________ Teacher ______________

Please indicate approximate grade for student at this time (ex. A,B,C etc.; 60's, 70's etc.). Also please rate student's progress on a 1-5 scale as follows;

5 - Excellent
4 - Very Good
3 - Good
2 - Fair
1 - Needs Improvement

	Rating	Comments
Attendance		
Attitude		
Homework		
Classwork		
Behavior		

Approximate Grade ________

Recommendations:

_____ Conference with resource teacher
_____ Parent conference with resource teacher
_____ Schedule change

____
Teacher

Please sign and return as soon as possible. Thank you.

The L.D. Teachers

Case #_______

Birthplace____________

WATERBURY PUBLIC SCHOOLS, WATERBURY, CONNECTICUT

INDIVIDUALIZED EDUCATIONAL PROGRAM - Total Service Plan

Spec. Serv. Form #6

School Year________

Student________________ Grade_____ School________________ Date of Birth____________

Starting Date____________ Projected Ending Date____________ Annual Review____________

SEMIS Code Number __________ Date of P.P.T. Meeting____________ Date of Initial I.E.P.____________

Summary of Present Levels of Student Performance and Evaluative Data:

Program Goal(s)	Specific Special Education and/or Related Services	Person(s) Responsible	Hours Per Week	Recommendations for Materials & Methods (if appropriate)	Evaluative Criteria

Other Recommendations:

Chairman, Planning & Placement Team____________

P.P.T. Members Present (name and position):

Recorder____________

Parent____________

I am in agreement with this I.E.P. Program____________

INTRODUCTION

INDUSTRIAL ARTS UNIT

The material in the Industrial Arts unit is a collaboration of efforts between ourselves and several teachers within the Industrial Arts Program for the City of Waterbury. Therefore, much of its content is based upon the curriculum for this school system.

The following shops are covered within this unit: Drafting, Electricity, Graphic Arts, Metalworking, Power Mechanics and Woodworking. These areas are based on introductory courses.

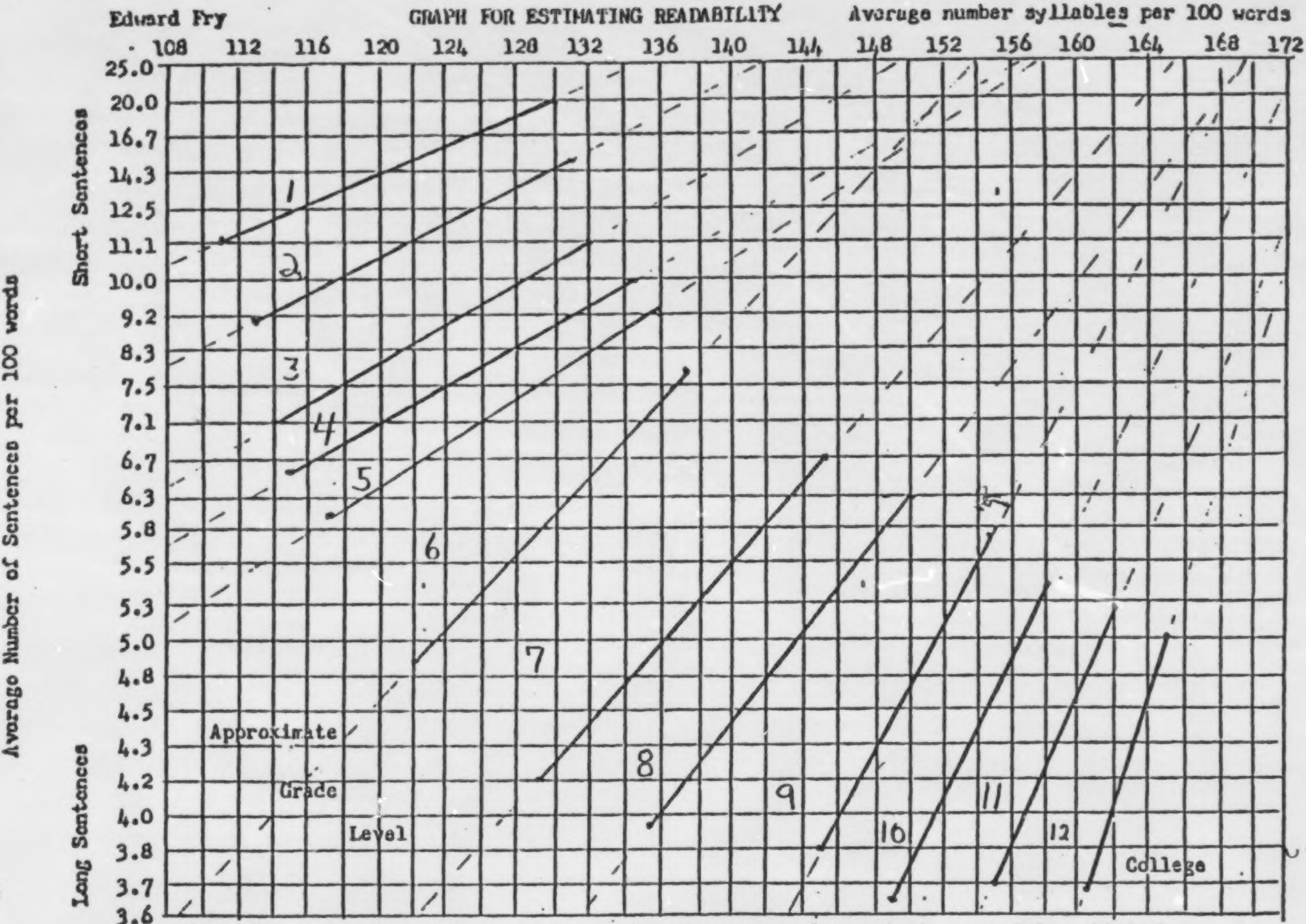
Each shop area begins with a brief introduction extracted from the Industrial Arts High-School Curriculum Guide for the Waterbury Public School System. General goals have been adapted from the characteristics of each program within the curriculum guide.

The readability levels established for the texts and supplements have been estimated from Edward Fry's Readability formula, (see attached). These approximated levels are to be interpreted as follows: (Ex. - 6.5 - sixth grade, fifth month.). At this instructional level, the student should be able to read and comprehend the material with the aid of the instructor.

The key word lists have been broken down phonetically and definitions have been altered to meet the needs of the special student.

General math skills for each area have been outlined for the use of the special educator in providing remediation or tutorial services for each shop course. The math pretest reflects these skills. This untimed test may be administered in various ways; for example, 1) administer to all students during the first week of class; 2) administer to only learning disabled students; 3) administered by special educator; 4) administered by Industrial Arts instructor; 5) administered by both; 6) used by guidance personnel as a tool for placement prior to students entrance to Industrial Arts classes. Please refer to page 24 for modifications in testing.

A skills checklist has been designed to be used by guidance counselors, special educators, and industrial arts instructors as a unified effort in student placement. One standard checklist is used, however, emphasized skills will be indicated for each area. Although asterisked skills in each area are stressed flexability remains for teacher discretion.



DIRECTIONS: Randomly select 3 one hundred word passages from a book or article. Plot the average number of syllables and average number of sentences per 100 words on the graph to determine the area of readability level. Choose more passages per book if great variability is observed. The dotted lines extending from the solid ones are not as reliable a gauge as are the solid line areas.

DRAFTING

Drafting is the universal language of industry conveying ideas and information through various lines, symbols, and techniques resulting in an exact representation of objects, plans, etc. It is the medium through which thoughts and ideas are conveyed into material objects and products. The drafting area encompasses: Visual Learning to perceive and imagine objects from all sides and angles - (i.e. How a single line can represent a plane or how a point may represent an entire line.) Being able to visualize is a basic factor in drafting at all levels. Development of skills in the use of equipment and in drafting ability of the student.

The understanding and assimilation of rules, concepts, and information pertinent to the application of these drafting elements creates a unique form of industrial communication comparable to reading and writing in importance and performs an indispensable role in our industrial society.

GENERAL GOALS

1. Students will acquire an ability to use acceptable drafting techniques in the production of working drawings, and will use effectively reference materials for drafting.

2. Students will learn to arrange various parts of a drawing in logical and readable combinations, and learn to picture accurately mechanisms and construction details.

3. Students will carry out drawings for finished products using sketches, details, assembly drawing, and necessary tabulations.

AREAS COVERED IN DRAFTING

SKETCHING - line quality, proportion, ability to reproduce from original.

LETTERING - line quality, letter formation.

PLATE DRAWING - measurement, application of drawing instruments, line quality.

ORTHOGRAPHIC PROJECTION - measurement, application of drawing instruments, multiview projection, dimensioning.

PICTORIAL DRAWING - Isometric, Oblique, Technical representations.

SAFETY PROCEDURES

1. Notify instructor immediately if injured.
2. Do not throw or toss objects.
3. Avoid horseplay or shouting.
4. Make sure work area is well lit and also well ventilated.
5. Hold all tools carefully. Make sure sharp tools (compasses, etc.) are held down when walking.
6. Place all compasses, pencils, tools, etc. back in the proper places when done with them.

READING

Texts Used:

1. Basic Technical Drawing Henry Spencer and John Dygdon; McMillan Publishing Co. Inc., 1974; New York, New York.

Readability Level: Approximately 7.5

Other Texts Used For Reference

1. Blueprint Reading For Industry Walter C. Brown; Goodheart Wilcox Publishers; South Holland, Illinois.

Readability Level: Approximately 11.7

Suggested Supplements:

1. The Basic Book of Drafting Paul Wallach; American Technical Society, 1979; Chicago, Illinois.

Readability Level: Approximately 6.0

KEY WORD VOCABULARY

(Selected List)

ANGLE
BLUEPRINT
CENTER LINE
CIRCLE
CIRCUMFERENCE
COUNTERBORE
COUNTERSINK
CROSS HATCHING
DETAIL DRAWING
DIAMETER
DIMENSIONING
ISOMETRIC
LETTERING
LINE CONVECTION
OBJECT LINE
OCTOGON
ORTHOGRAPHIC PROJECTION
PENTAGON
PERIMETER
PERSPECTIVE DRAWING
RADIUS
RIGHT ANGLE
SCALE
SECTION
SKETCH
SYMBOL

DRAFTING

DEFINITIONS

Angle (ăng′l) - a figure formed by two lines coming together to a point.

Blue print (Blōō Prĭnt) - a drawing that has been transferred to a sensitized paper by exposure to light and some type of developer.

Center Line (sĕn′ter līn) - a line that marks a center of a hole.

Circle (sir′cle) - a closed curve in which all points are equal in distance from its center.

Circumference (sir kŭm′fer ĕnts) - the outer rim of a circle.

Counterbore (koun′ ter bor) - enlarging the end of a hole.

Countersink (koun′ter sink) - the enlarging of the beginning of a hole to level a screw's head.

Cross Hatching (kraws hăch′ing) - lines that are used to represent sectional views.

Detail Drawing (dē′tāl draw′ing) - a drawing in detail of a single part.

Diameter (dī ăm′ə ter) - the length of a straight line which runs through the center of a circle.

Dimensioning (dī mĕn′shŭn ing) - placing number sizes on a drawing.

Isometric (ī sō mĕ′trĭk) - pictorial drawing offset on 30° axis.

Lettering (lĕt′er ing) - standard letters that help others to read drawings.

Line Conventions (līn cŭn vĕn′shŭn) - symbols which represent some part of an object.

Object Line (ŏb′jĕct līn) - the heavy full line on a drawing which describes the object.

Octagon (ŏct ə̄′ gŏn) - an 8 sided geometric shape.

Orthographic Projection (or thō gră′phĭc Prō jĕk′shŭn) - a multiview drawing that shows each object in its true size and shape.

Pentagon (pĕn′ tə gŏn) - a 5 sided geometric shape.

DEFINITIONS CONTINUED

Perimeter (per ĭm′ ə ter) - boundary of a geometric form.

Perspective Drawing (per spĕk′ tĭv draw′ing) - a drawing showing an object on a single plane as it appears to the eye.

Radius (rā′dē ŭs) - the length of a straight line which runs from the center of a circle to its outer edge (perimeter).

Right Angle (rīt ăng′l) - 90 degree angle

Scale (scāl) - size representation of an object in a drawing.

Section (sĕk′shŭn) - inside view of an object and its make-up.

Sketch (skĕch) - drawing without the aid of drafting tools.

Symbol (sĭm′bəl) - a figure used instead of a word.

TOOLS

(Selected List)

ADJUSTABLE TRIANGLE

BEAM COMPASS

BOW COMPASS

DIVIDERS

DRAFTING BOARD

DRAFTING PAPER

DRAFTING SCALE

DRY CLEANING PAD

DUSTING BRUSH

ERASER

ERASING SHIELD

FRENCH CURVES

MASKING TAPE

MECHANICAL PENCIL LEAD

MECHANICAL PENCIL POINTER

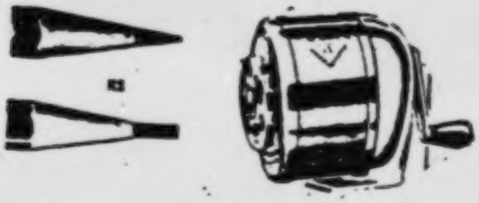
PENCIL SHARPENER

PROTRACTOR

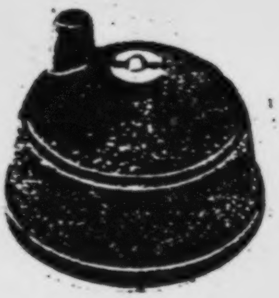
TEMPLATE

TRIANGLES

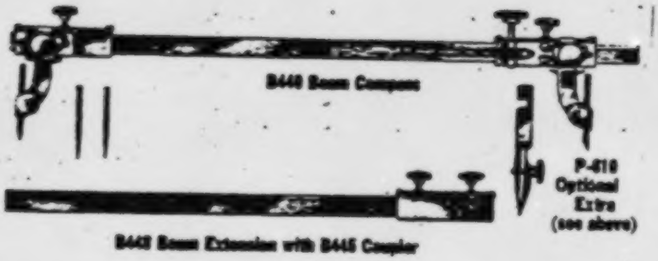
T-SQUARE



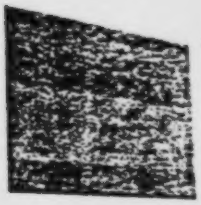
Pencil Sharpener



Mechanical Pencil Pointer


B440 Beam Compass
P-610 Optional Extra (see above)
B442 Beam Extension with B445 Coupler

Beam Compass



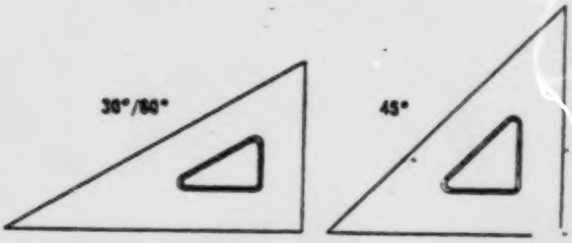
Drafting Board

Drafting Paper

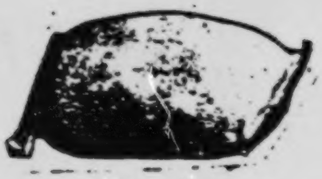
DRAWING LEADS

Mechanical Pencil Lead

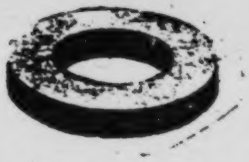
Mechanical Pencil



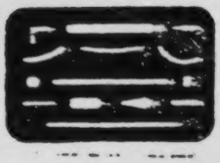
Triangles



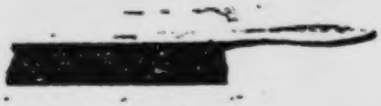
Dry Cleaning Pad



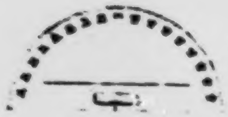
Masking Tape



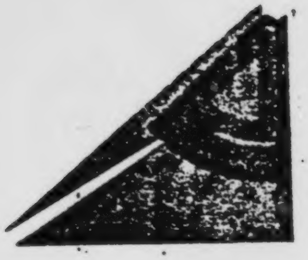
Erasing Shield



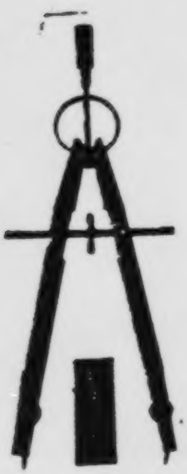
Dusting Brush



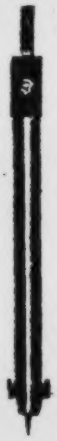
Protractor



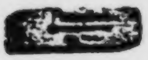
Adjustable Triangle



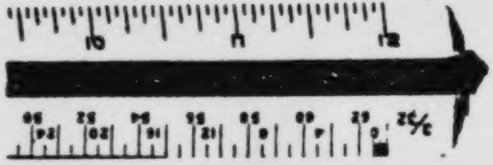
Bow Compass



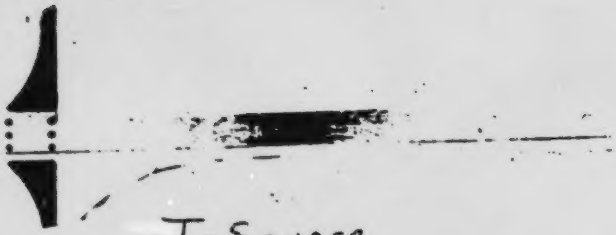
Dividers



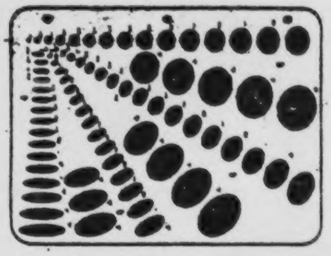
Eraser



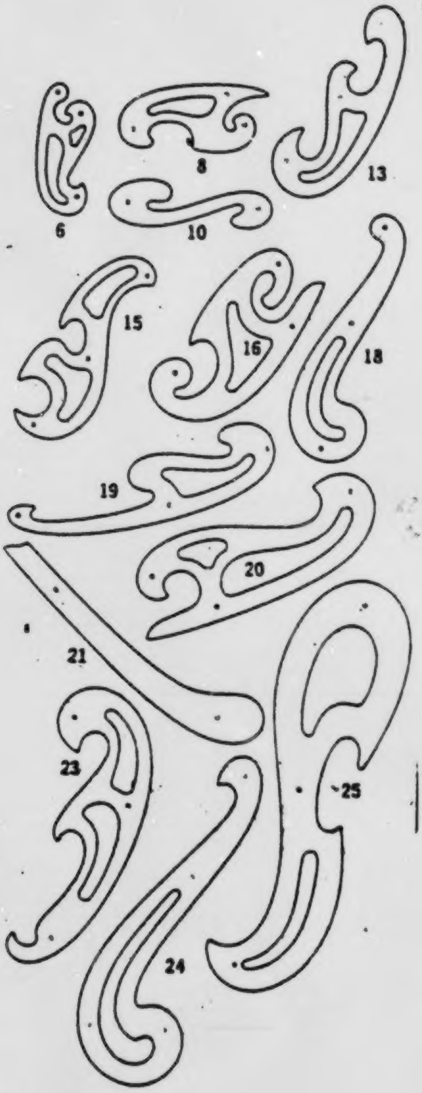
Drafting Scale



T-Square



Template


6
8
10
13
15
16
18
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21
23
24
25

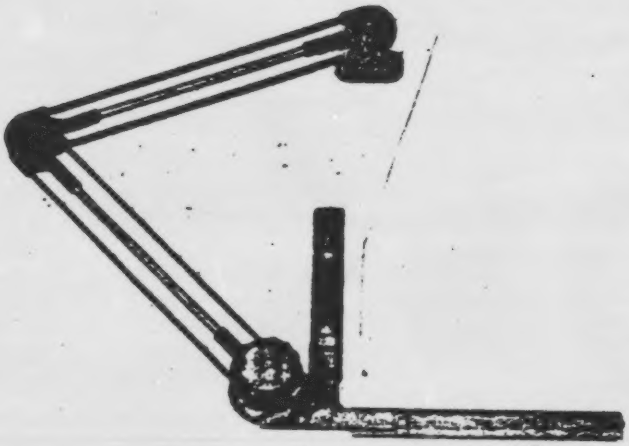
French Curves

MACHINES

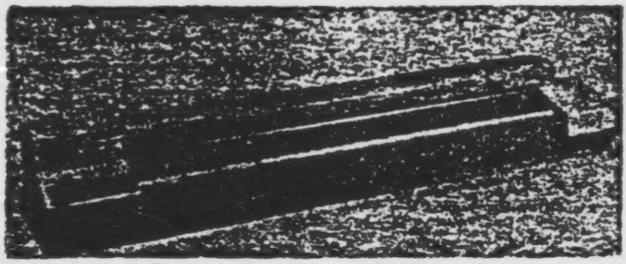
(Selected List)

DIAZO BLUEPRINT COPIER

DRAFTING MACHINE



Drafting Machine



Diazo BluePrint Copier

MATH SKILLS

1. WHOLE NUMBERS
    - A. Addition
        - 3 digit addends with regrouping
    - B. Subtraction
        - 3 digit subtrahend with 3 digit minuend with regrouping
    - C. Multiplication
        - 3 digit multiplicand by a 3 digit multiplier
    - D. Division
        - 3 digit dividend by a 1 digit divisor

2. DECIMALS
    - A. identify place value to .001
    - B. addition of 2 digit addends with regrouping
    - C. subtraction of 2 digit subtrahend and minuend with regrouping
    - D. convert decimals to fractions

3. FRACTIONS
    - A. identifies fractions
    - B. equivalent fractions - reducing and in higher terms
    - C. reciprocal of a fraction
    - D. conversion of a mixed number
    - E. addition of fractions with common and uncommon denominators
    - F. subtraction of fractions with common and uncommon denominators
    - G. multiplication of fractions and mixed numbers
    - H. division of fractions and mixed numbers
    - I. conversion of fractions to decimals

4. MEASUREMENT

A. Ruler

- identify on ruler inch, 1/2 inch, 1/4 inch, 1/8 inch 1/16 inch
- measure to 16ths
- conversion of inches to feet and feet to inches

B. Angles

- identify right triangle
- measure angles with use of protractor
- drawing angles with use of protractor
- add, subtract, angles

C. Circles and Lines

- identify names of common figurea - circle, triangle, rectangle, pentagon, and octogon
- measure radius and diameter of common figures
- draw common figures with use of compass and protractor and ruler
- identify length, width, and height of figures
- identify types of lines - horizontal, vertical, inclined, parallel and perpendicular

MATH VOCABULARY

INCHES
FEET
NUMERATOR
DENOMINATOR
RECIPROCAL
CIRCLE
SQUARE
TRIANGLE

RECTANGLE
PENTAGON
OCTAGON
ARC
DIAMETER
RADIUS
HORIZONTAL LINE
VERTICAL LINE

INCLINED LINE
PARALLEL LINE
PERPENDICULAR
SCALE
PROTRACTOR
COMPASS
LENGTH
WIDTH
HEIGHT

PRETEST

$\begin{array}{r} 22 \\ \underline{+75} \end{array}$ $\qquad$ $\begin{array}{r} 321 \\ \underline{+158} \end{array}$ $\qquad$ $\begin{array}{r} 548 \\ \underline{+297} \end{array}$

$\begin{array}{r} 85 \\ \underline{-71} \end{array}$ $\qquad$ $\begin{array}{r} 627 \\ \underline{-105} \end{array}$ $\qquad$ $\begin{array}{r} 986 \\ \underline{-199} \end{array}$

$\begin{array}{r} 58 \\ \underline{x25} \end{array}$ $\qquad$ $\begin{array}{r} 345 \\ \underline{x18} \end{array}$ $\qquad$ $\begin{array}{r} 561 \\ \underline{x184} \end{array}$

$2\overline{)80}$ $\qquad$ $8\overline{)456}$ $\qquad$ $7\overline{)189}$

Identify in written form:

.15 ________________________

.40 ________________________

.666 ________________________

$\begin{array}{r} .28 \\ \underline{+.11} \end{array}$ $\qquad$ $\begin{array}{r} 1.80 \\ \underline{+.75} \end{array}$ $\qquad$ $\begin{array}{r} 3.65 \\ \underline{+.12} \end{array}$

Subtract: 8.9 - .7 $\qquad$ 5.62 - 1.38

Change these decimals to fractions and reduce:

.50 $\qquad$ .75 $\qquad$ .125

Reduce to lowest terms:

$\frac{5}{10}$ $\qquad$ $\frac{10}{40}$ $\qquad$ $\frac{20}{80}$

$\frac{5}{8} = \frac{?}{16}$ $\qquad$ $\frac{3}{4} = \frac{?}{16}$ $\qquad$ $\frac{7}{16} = \frac{?}{32}$

Change these mixed numbers to improper fractions:

2 1/2 $\qquad$ 3 5/8

Add these fractions and reduce:

1 3/8 + 1/8 = 2 5/16 + 4 1/2 =

Subtract these fractions and reduce:

2 5/16 - 1 3/16 = 5 9/32 - 3 1/6 =

Multiply these fractions and reduce:

1/2 x 1/4 = 5 3/16 x 7/8

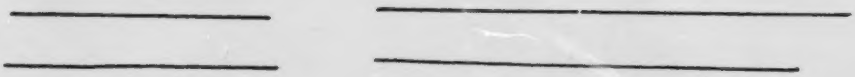
Divide these fractions and reduce:

3/4 ÷ 1/2 4 3/8 ÷ 1 1/4

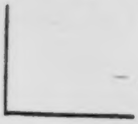
Convert to decimals;

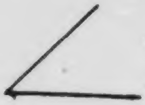
3/4 5/8 1 3/16

Measure these lines with a ruler:

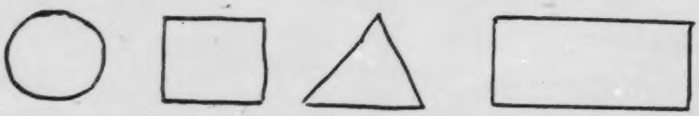


Measure these Angles:



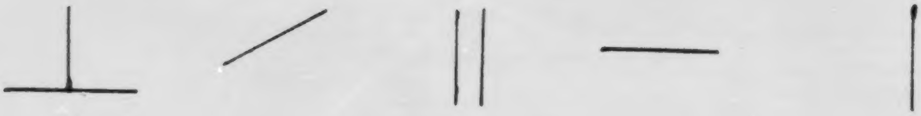


Identify these Figures:



Match the following lines with their names:

horizontal vertical inclined parallel perpendicular



RELATED TEACHING AIDS

Overheads and Transparencies

1. DCA Educational Products, Warrington, Pa. 1981

   The ABC's of Drafting

   Group I Basic Skills (15 transparencies - 11 overlays)

   Group II Size and Shape Descriptions (8 transparencies - 11 overlays)

   Group III Pictorial Drawing (13 transparencies - 6 overlays)

   Architectural Drafting (27 transparencies - 67 overlays)

   Machine and Engineering Drafting (26 transparencies - 103 overlays)

   Mechanical Drafting

   Group I Geometric Construction (2 transparencies - 12 overlays)

   Group II Orthographic Projection (16 transparencies - 51 overlays)

   Group III Working Drawing Lost Edges - Machine Operations (8 transparencies - 25 overlays)

   Group IV Scale Drawing (2 transparencies - 5 overlays)

   Group V Types of Pictorial Drawing (10 transparecies - 20 overlays)

   Group VI Isometric Drawing (20 transparencies - 53 overlays)

   Group VII Section Drawing (12 transparencies - 22 overlays)

Vocational Films

1. The Language of Drawing McGraw-Hill Book Co., Text Film Division; New York, New York

2. Freehand Drafting Purdue University - Audio Visual Aids Library; University Park, Pa.

3. The World of Work The Library of Career Counseling Filmstrips, Counselor Films Inc., Career Future Inc., Philadelphia, Penn.

RELATED OCCUPATIONAL OPPORTUNITIES

INDUSTRIAL DRAFTSMAN

ELECTRICAL DRAFTSMAN

ARCHITECT

ADVERTISING DESIGNER

INTERIOR DESIGNER

FASHION DESIGNER

PRODUCT DESIGNER

BLUEPRINT MAKER

SKILLS CHECKLIST

DRAFTING

		XCELLENT ABILITY	MODERATE ABILITY	LIMITED ABILITY
POSITION	stand			
	sit *			
	lie			
	bend forward			
GROSS MOTOR	walk			
	push			
	pull			
	carry			
	lift (50 lb.)			
	limb flexibility			
	hand-foot coordination			
FINE MOTOR	eye-hand coordination *			
	hand-finger mobility *			
	eye-foot coordination			
TACTILE	discrimination			
VISUAL SKILLS	visual acuity *			
	color vision			
	peripheral vision			
	memory *			
	discrimination *			
	figure ground *			
	depth perception *			
	spatial orientation *			
	directionality *			
AUDITORY SKILLS	hearing acuity			
	memory			
	discrimination			
	figure ground (background noise)			
LANG. & COMMUN.	following directions *			
	talk above background noise			
SOCIAL	cooperation with instructor *			
	cooperation with peers *			
	working in a group situation *			
BEHAVIOR	attendance *			
	conduct *			
	attitude *			
	attention span *			
	respect for property *			
OTHER SKILLS				

ELECTRICITY

Electricity is an essential and extensive part of our technical and industrial society.

The electricity shop provides a laboratory in which the student may explore the production, transmission and the use of electricity effectively and safely. This knowledge and experience helps develop an appreciation of good workmanship and new outlooks in his relationship to electricity. Practical applications can then be drawn to the students' occupational interests, consumer knowledge, self-confidence, safety, academic relevence and effective citizenship.

GENERAL GOALS

1. Students will gain knowledge and skill in the operation and use of basic electrical tools and devices.
2. Students will acquire basic concepts of electrical theory, electrical devices, production, transmission and use of electrical energy.
3. Students will acquire an understanding of related information enabling them to perform cooperatively, safely, and practically.

AREAS COVERED IN ELECTRICITY

INTRODUCTION - historical background, terms, symbols, Ohm's Law, Power Law, Conversions, Series and Parallel circuits.

MULTIMETERS - functions, maintenance.

ENERGY CONVERSIONS - amps, volts, resistance.

MOTORS AND GENERATORS - electromagnets, application, inductance, generators, transformers.

ELECTRONICS - capacitors, transistors, schematics.

SOLDERING - types, soldering light and heavy wire.

HOUSEWIRING - for real life situations

SAFETY PROCEDURES

1. Notify instructor immediately when injured.
2. Check with instructor if there is doubt in proper operation of equipment.
3. Use the right tool for the right job.
4. While in shop area, wear safety glasses at all times.
5. Avoid horseplay - this causes accidents.
6. Know location and proper use of fire extinguishers.
7. Avoid working with electrical projects in wet or damp areas.
8. Do not stick wires in electrical outlets - 110 Volts can kill!
9. Lamp and appliance cords that are worn should be replaced; an exposed conductor can cause shock.
10. Handle soldering irons with care - they are hot and can burn.
11. When working with batteries or other acid experiments, avoid getting acid on clothes or skin. Remove as much acid as possible with baking soda and cool water.
12. Be careful when working with coils and transformers; even a small one can give a tremendous shock.
13. Discharge capacitor circuits before working on them.

READING

Texts Used:

1. *Exploring Electricity/Electronics* Thomas Kraus, Philip Rollain; Delmar Publishers, 1971; Albany, New York.

Readability Level: Approximately 10.5

2. *Housewiring Simplified* Floyd Mix; Goodheart Wilcox Co. Inc. Publishers, 1977; South Holland, Illinois.

Readability Level: Approximately 9.5

Other Texts Used As Reference:

1. *The Encyclopedia of Homewiring and Electricity* Martin Clifford; Drake Publishers, 1974; New York, New York.

Readability Level: Approximately 8.5

Suggested Supplements:

1. *The Basic Book of Electricity* Gerald Williams; American Technical Society, 1979; Chicago, Illinois.

Readability Level: Approximately 6.5

KEY WORD VOCABULARY

(Selected List)

AMPERE
ARMATURE
CAPACITANCE
CONDUCTOR
CONNECTOR
CORE
CURRENT
DEMAGNETIZE
ELECTRON
FIELD
FISSION
FLOURESCENT
FREQUENCY
FRICTION
FUSION
GROUND
INCANDESCENT
INDUCTANCE
LOADS
MAGNETIZE
NEGATIVE CHARGE
OHM'S LAW
POLARITY
POWER RATE
POSITIVE CHARGE
RESISTANCE
SCHEMATIC DIAGRAM
SPLICE
STATIC ELECTRICITY
STRIPPING
VOLTAGE
WATT'S LAW
WIRING

ELECTRICITY

DEFINITIONS

* Ampere (ăm′per) - a unit of electrical current.

* Armature (ar′mə cher) - the rotating part of an electrical motor or generator.

Capacitance (kə păs′ ĭ tĕnts) - holding a charge of electricity.

* Conductor (kŭn dŭk′ tor) - a material that can carry electricity.

** Connector (kŭn ĕkt′ or) - a device that joins two or more conductors by means of mechanical pressure.

Core (kor) - the iron bar that has insulated wire around it to make it a magnet.

* Current (ker′ĕnt) - electrons in motion, the unit is called an ampere.

Demagnatize (dē măg′ nə tīz) - reversing current flow which causes material to attract iron.

Electron (ē lĕk′ trŏn) - a tiny particle that carries a negative charge.

Field (fēld) - magnetic flux around an electromagnet.

Fission (fĭ′zhŭn) - splitting of atoms.

Flourescent (flor ĕs′ ĕnt) - a glow produced by certain gases that are energized by an electrical current.

Frequency (frē′kwən sē) - cycles of vibration, electricity that changes the direction of flow (ex. - the human voice).

Friction (frĭk′shŭn) - the resistance of movement of two flat surfaces that are touching each other.

Fusion (fū′zhŭn) - the union of two parts as in an atom.

Incandescent (ĭn căn dĕs′ ənt) - a filament heated by the flow of electrons to a high temperature.

Inductance (ĭn dŭk′tənts) - flowing of electricity through a coil of wire that creates a magnetic field.

DEFINITIONS CONTINUED

** Insulator (ĭn′sŭl ā tor) - nonconductor used to support current-carrying conductor.

Loads (lōdz) - an electrical device that uses electricity.

** Magnetize (măg′nə tīz) - providing invisible force which causes material to attract iron.

Negative Charge (nĕg′ə tĭv charj) - more electrons than protons in an electrical device.

Ohm's Law (Ōm'z law) - a formula devised by George Ohm
E = I x R or voltage is equal to the current times resistance.

** Polarity (pō lar′ə tē) - identification of voltage - positive or negative.

Positive Charge (pŏz′ĭ tĭv charj) - more protons than electrons in an electrical device.

** Resistance (rē zĭs′tĕns) - quality of electrical circuit measured in Ohms that slows down the current flow.

* Schematic Diagram (skē măt′ĭc dī ə grăm) - a diagram that shows how to connect electrical and electronic parts together.

** Splice (splīs) - connection made by joining two or more wires.

Static Electricity (stăt′ĭc ē lĕk trĭs′ĭ tē) - a negative charge built up in an object created by friction (ex. - lightning).

Stripping (strĭp′ing) - removal of insulation from wire.

Voltage (vōl′tĭj) - electrical force that pushes current through a circuit.

Watt's Law (wŏt's law) - a formula devised by James Watt
P = I x E or Power equals the current times the voltage (power is the rate at which we use energy).

Wiring (wīr′ing) - carrying electricity to electrical devices through copper wire.

* Cited in The Basic Book of Electricity

** Cited in Housewiring Simplified

TOOLS

(Selected List)

Brace and Bit (auger)

Coping Saw

Hammer

Lineman"s Pliers

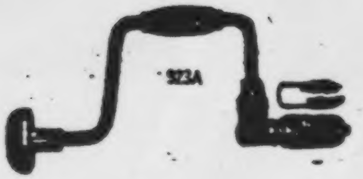
Needle Nose Pliers

Ruler

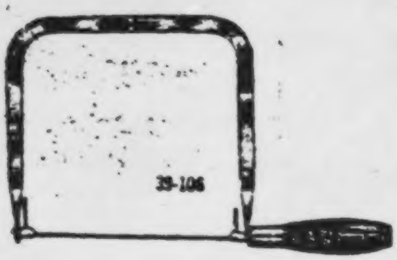
Screwdriver

Soldering Gun

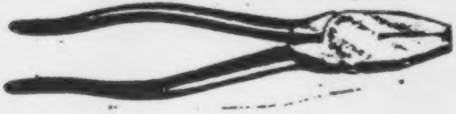
Tin Snips



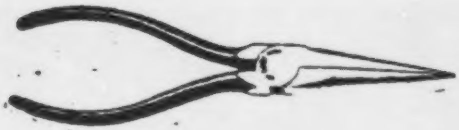
Auger Brace



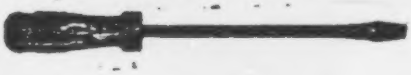
Coping Saw



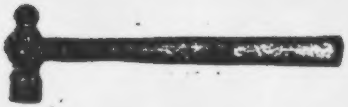
Linesman's Pliers



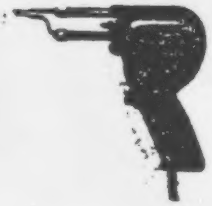
Needle Nose Pliers

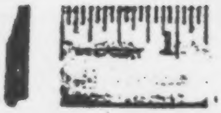


Screwdriver

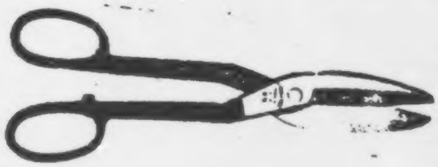


Hammer (Ballpeen)





Ruler



Soldering Gun

Tin Snips

EQUIPMENT

(Selected List)

Power Supply

Voltmeter

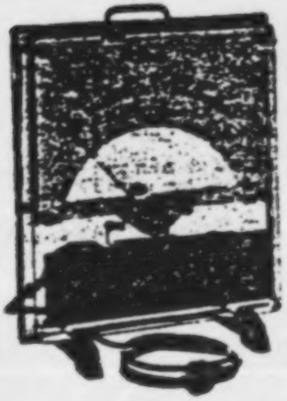
Ammeter

Drill Press

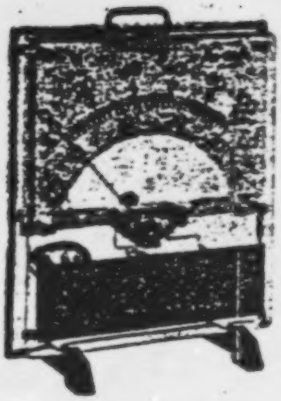
Soldering Iron

Ohmmeter

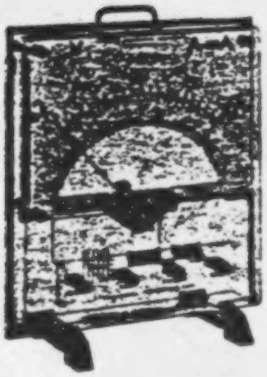
Multimeter



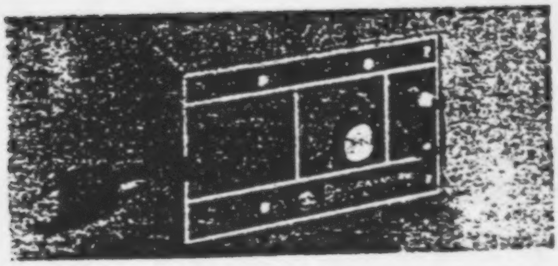
Ohmmeter



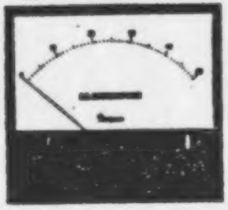
Multimeter



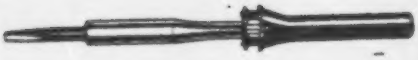
Voltmeter



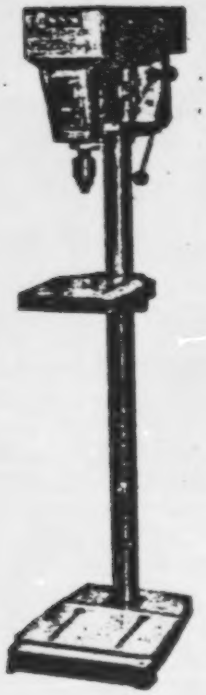
Power Supply



Ammeter



Soldering Iron



Drill Press

SUPPLIES

(Selected List)

Batteries
Resistors
Transistors
Capacitors
Diodes
Pot. (Potentionmeter)
Speaker
Headphones
Transformers
Lamp
Fuses
Switch
Antenna
Crystal Piezo
Tube Triode

MATH SKILLS

1. WHOLE NUMBERS

A. Addition

- 1,2,3, digit addends with regrouping and in column form

B. Multiplication

- 2,3 digit multiplicand by a 2 digit multiplier

C. Division

- 3 digit dividend by a 2 digit divisor

D. Place Value

- one thousand, one million

2. FRACTIONS

A. identify fractions (proper and improper)

B. find common denominator

C. add fractions

D. reducing improper fractions to whole numbers

3. DECIMALS

A. identify place value for .001 to .000001

B. convert whole numbers to thousandths and millionths (by moving decimal point to right or left)

4. MATH VOCABULARY

Kilo - 1000

Mega - 1,000,000

Mili - 1/1000 or .001

Micro - 1/1,000,000 or .000001

Remember:

1. OHM's Law
   $E = I \times R$
2. Watt's Power Law
   $P = I \times E$

PRETEST

$\begin{array}{r}10\\20\\+30\\\hline\end{array}$ $\qquad$ $\begin{array}{r}100\\60\\+35\\\hline\end{array}$ $\qquad$ 25 + 60+ 85+ 110 =

$\begin{array}{r}40\\\times2\\\hline\end{array}$ $\qquad$ $\begin{array}{r}56\\\times37\\\hline\end{array}$ $\qquad$ $\begin{array}{r}381\\\times46\\\hline\end{array}$

$3\overline{)93}$ $\qquad$ $24\overline{)288}$ $\qquad$ $15\overline{)375}$

Identify the missing number:

1; 10; ______; 1,000; ______; 100,000; __________

Identify fraction as Proper or Improper.

1/2 ______________ $\qquad$ 9/20 ______________

3/8 ______________ $\qquad$ 25/25 ______________

15/5 ______________ $\qquad$ 42/6 ______________

Add these fractions:

3/10 + 5/10 = $\qquad$ 8/30 + 15/30 = $\qquad$ 3/4 + 1/2 =

Reduce these fractions to whole numbers:

10/5 =   80/20 =   125/25 =   240/20 =

Identify these decimals:

.001 ______________

.00001 ______________

.000001 ______________

Using this conversion chart; convert the following electrical quantities:

1,000,000	1,000	Unity	1/1000	1/100,000
1 Megavolt	1 Kilovolt	1 Volt	Millivolt	1 Microvolt
1 Megawatt	1 kilowatt	1 Watt	Milliwatt	1 Microwatt

Change .2 of a volt to millivolts ______________

Change 5000 millivolts to volts ______________

Change 5 watts to megawatts ______________

Change 200 microwatts to milliwatts ______________

Given this formula: E = I x R, find answers for the missing elements.

E = 250
I = ______
R = 50

E = ______
I = 10
R = 30

E = 150
I = ______
R = 25

RELATED TEACHING AIDS

Filmstrips and Cassette Sets

1. Bergwall Productions; Garden City, New York

# 801 Basic Electricity

1. The Electron Theory
2. Electrical Wiring Techniques
3. Meter Reading and Ohm's Law
4. Series Circuits
5. Parrallel Circuits
6. Resistor and Complex Circuits

802 Basic Electricity

1. Alternating Current - What It Is and Where It Is Used?
2. Alternating Current - Voltage and Power
3. Oscilloscopes and How to Use Them?
4. Oscilloscope Operation - Measuring Voltage
5. Oscilloscope Operation - Determining Frequency

803 Electrical Housewiring Operation

1. National Electrical Code and Requirements
2. Circuits, Symbols, and Diagrams
3. Receptacles and Ground Fault Interrupters
4. Switch Control
5. Three-Way and Four-Way Switches
6. Fuse Circuit Breaker Panals

804 Residential Electrical Wire

1. Estimating the Job
2. Planning the Job
3. Underground Service Entrance
4. Roughing in the Wiring
5. Recessed Fixture Installation

Vocational Filmstrips

1. The Library of Career Counseling Filmstrips, Counselor Films Inc., Career Future Inc., Philadelphia, Penn.

   Set 1 #1 The World of Work

   Set 3 #3 Is a Career in Electrical Manufacturing For You?

RELATED OCCUPATIONAL OPPORTUNITIES

Electricians

- Maintenance Electricians
- Construction Electricians

Electronic Service Technician

- Televisions, Radios, Etc.

Appliance Servicemen

- Toasters, Irons, Etc.

Manufacturing

- Computers
- Broadcasting Equipment - (Radio and Television Equipment)
- Aircraft Communications
- Navigational Aids
- Consumer Products - (Televisions, Radios, Hearing Aids, Etc.)

Telephone Industry

- Installer
- Repair
- Lineman

SKILLS CHECKLIST

ELECTRICITY

		EXCELLENT ABILITY	MODERATE ABILITY	LIMITED ABILITY
POSITION	stand			
	sit *			
	lie			
	bend forward			
GROSS MOTOR	walk			
	push			
	pull			
	carry			
	lift (50 lb.)			
	limb flexibility			
	hand-foot coordination			
FINE MOTOR	eye-hand coordination *			
	hand-finger mobility *			
	eye-foot coordination			
TACTILE	discrimination			
VISUAL SKILLS	visual acuity *			
	color vision *			
	peripheral vision			
	memory *			
	discrimination *			
	figure ground			
	depth perception			
	spatial orientation			
	directionality *			
AUDITORY SKILLS	hearing acuity			
	memory *			
	discrimination			
	figure ground (background noise)			
LANG. & COMMUN.	following directions *			
	talk above background noise			
SOCIAL	cooperation with instructor *			
	cooperation with peers *			
	working in a group situation *			
BEHAVIOR	attendance *			
	conduct *			
	attitude *			
	attention span *			
	respect for property *			
OTHER SKILLS				

GRAPHIC ARTS

Graphic arts provides a laboratory in which the student will develop proficiency in the skills of type composition, presswork, photography, silk screen, offset printing, duplicating processes and proof-reading. The history of printing, the importance of printing and vocational opportunities are emphasized. Students learn an appreciation for printing and develop abilities relating to selecting and purchasing of printed materials. Graphics will include many practical applications of English, mathematics, and art skills regarding such matters as composition, spelling, punctuation, proportion, layout, and design. Course skills which students learn also have industrial significance. By mass producing an article, the students become familiar with the organization, planning, research, and production inherent in the mass production technique. Future application of these skills and knowledge may be vocational, or of consumer nature.

GENERAL GOALS

1. The student will acquire knowledge and skills in the operation and use of common graphic arts machines and tools.

2. The student will become acquainted with the elements of printing and the concepts of the printing industry.

3. The student will acquire an understanding of the graphic arts processes, the related information which will enable him to plan logical work procedures, and make other judgements which relate to his work.

AREAS COVERED IN GRAPHIC ARTS

PHOTOGRAPHY - shoot and develop a negative, make cotact positive

SILK SCREEN - cut out and adhere stencil, ink and make copies

BINDING AND PAPER CUTTING - in making pads

LETTERPRESS PRINTING - layout, composition, and justification of letter press job

OFFSET PRINTING - design and produce simple offset copy

PROCESS CAMERA - expose and develop a simple paste-up

SAFETY PROCEDURES

1. Notify instructor immediately when injured.

2. Do not operate equipment without instructor permission.

3. Do not operate equipment without prior instruction.

4. Eye protection is mandatory when handling dangerous materials.

5. Only one operator at a time when using machines.

6. Do not look directly into strong lighting.

7. Loose clothing must be tucked in and long hair must be tied back.

8. Do not try to adjust or clean machines while they are running.

9. Prevent over-inhaling by proper ventilation of vapors from solutions, mixtures, chemicals, cleaning fluids etc.

10. Do not operate equipment while ill or in any state of an unclear frame of mind.

11. Do not sit or place heavy objects on light tables.

12. Do not throw or toss objects. Avoid needless shouting.

13. Be knowledgeable of materials that may cause injuries if handled incorrectly.

14. Do not touch heated equipment.

15. Clean up materials, machines, tools etc. before class dismissal.

READING

Texts Used:

1. Photo Offset Fundamentals John Cogoli; McKnight Publishers, 1973; Bloomington, Illinois.

   Readability Level: Approximately 8.2

2. Graphic Communication Richard Brockhuizen; McKnight Publishers, 1979; Bloomington, Illinois.

   Readability Level: Approximately 8.5

3. Graphic Arts Darvey Carlsen; Chas A. Bennett Publishers, 1977; Peoria, Illinois.

   Readability Level: Approximately 8.7

4. Modern Graphic Arts Paste-Up Gerald A. Silver Ed. D; American Technical Society, 1973; Chicago, Illinois.

   Readability Level: Approximately 8.7

Suggested Supplements:

1. The Basic Book of Graphics Robert M. Swerdlow; American Technical Society, 1979; Chicago, Illinois.

   Readability Level: Approximately 6.2

KEY WORD VOCABULARY

(Selected List)

BAKELITE
BLANKET
BLANKET WASH
BLUE ETCH
CHASE
DEVELOPER
DIRECT IMAGE PLATE
FILM HOLDER
FIXER
FONT
FOUNTAIN CONCENTRATE
GALLEY
LEADS AND SLUGS
LENS
LOCK UP
MATRIX
NEGATIVE
PADDING CEMENT
PASTE-UP
PICA
POINT
PRINT
POSITIVE
QUOIN
SHUTTER
STOP BATH
WOOD FURNITURE

GRAPHIC ARTS

DEFINITIONS

Bakelite (bāk′līt) - any of a group of hard, heat resistant plastics.

Blanket (blang′kĕt) - a rubber mat which receives the image reversed from the plate on an offset press.

Blanket Wash (blang′kĕt wash) - cleaning fluid used to remove ink from offset blanket and rollers.

Blue Etch (blo͞o ĕch) - liquid used to repel ink.

Chase (chās) - rectangular frame used in lock-up.

Developer (dĭ vĕl′ŭp er) - chemical needed to make prints and negatives.

Direct Image Plate (der ĕct′ ĭm′ j plāt) - paper plate directly drawn upon to reproduce copies.

Film Holder (fĭlm hōld′er) - an object that holds film light tight.

Fixer (fĭks′er) - chemical used to make a print or negative permanent.

Font (fŏnt) - a complete alphabet of type.

Fountain Concentrate (foun′tĕn kŏn′sĕn trāt) - liquid mixed with water to keep offset plate moist.

Galley (găl′ lē) - tray used to store type.

Leads and Slugs (lĕdz and slŭgz) - used for spacing between lines of type.

Lens (lĕnz) - curved piece of glass used to form an image or picture.

Lock-Up (lŏk ŭp) - the holding of type in a chase using wood furniture and quoins.

Matrix (mā′trĭks) - the mold for rubber stamp making.

Negative (nĕg′ ə tĭv) - a photographic film which shows a picture in reverse.

Padding Cement (păd′ing sə mĕnt′) - glue used in building pads.

DEFINITIONS CONTINUED

Paste Up (pāst ŭp) - a group of drawings, pictures or artwork placed on paper for photo reproduction.

Pica (pī´kə) - unit of measure used in printing equal to 12 points or 1/6 inch.

Point (point) - unit for measuring type equal to 1/72 inch.

Print (prĭnt) - a photo from a negative.

Positive (pŏz´ĭ tĭv) - reversed negative for photo silk screening.

Quoins (koinz) - a piece of metal used for locking type in a chase.

Shutter (shŭt´er) - a camera part which permits light to pass into it.

Stop Bath (stŏp băth) - a chemical used to stop the development of film.

Wood Furniture (wo͝od fer´nĭ cher) - wooden blocks used in locking up type.

TOOLS

(Selected List)

BRAYER

COMPOSING STICK

DEVELOPING TRAYS

GAUGE PIN

INK KNIFE

KEY, QUOIN, CHASE

MASKING TAPE

PADDING BRUSH

PADDING CEMENT

PERFORATING RULE

PLATE BRUSH

PRINTER's SCALE

RAZOR KNIFE

RUBBER CEMENT

RUBBER STAMP MOUNTING RULE

RULER

SAFE LIGHT

SCISSORS

THERMOMETER

THERMOSTATIC SUPPLY VALVE

TIMER

45° TRIANGLE

30°- 60°- 90° TRIANGLE

T - SQUARE

TWEEZER

WOOD PLANER

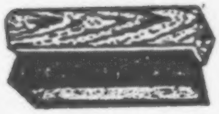
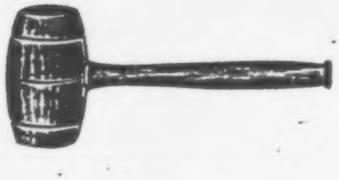
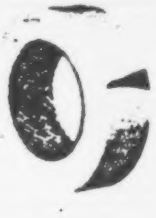


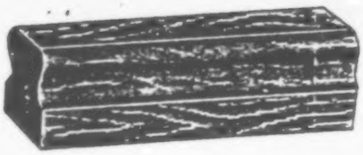
Plate Brush



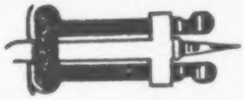
Wood Mallet



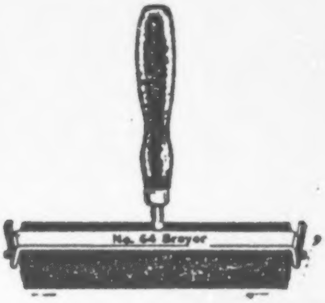
Masking Tape



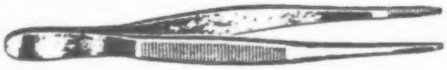
Wood Planer



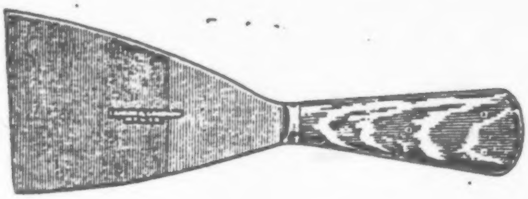
Gauge Pin


No. 64 Brayer

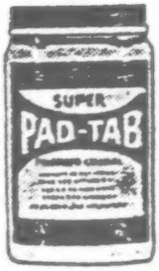
Brayer



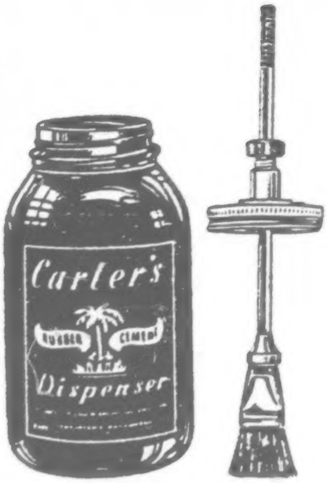
Tweezer



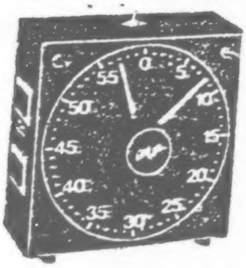
Ink Knife


SUPER
PAD-TAB

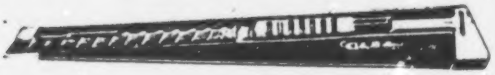
Padding Cement


Carter's
Rubber Cement
Dispenser

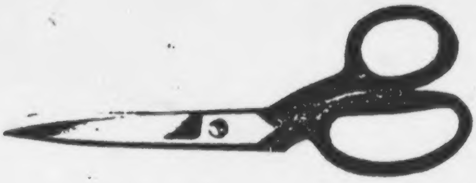
Rubber Cement



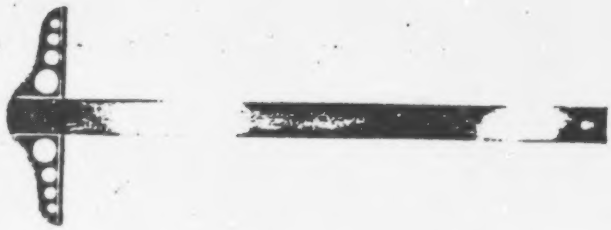
Timer



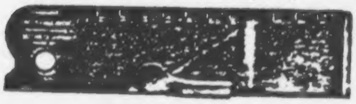
Razor Knife



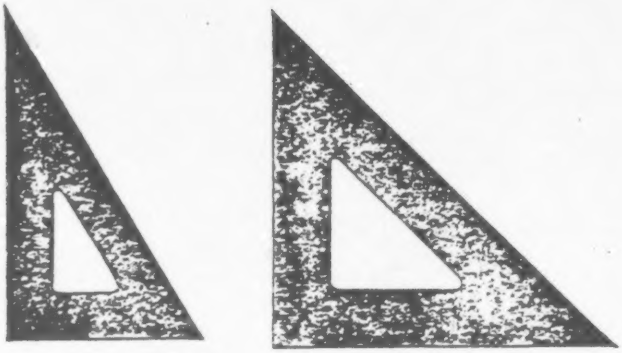
Scissors



T-Square



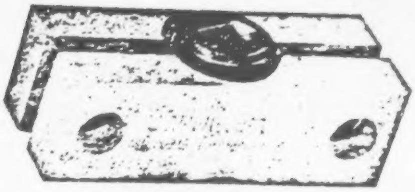
Composing Stick



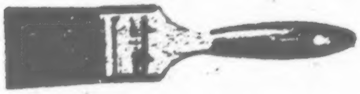
30° 60° 90°

45°

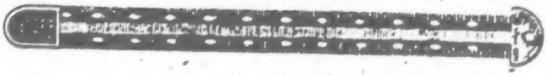
Triangle



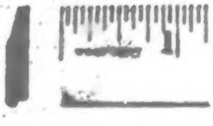
Quoins



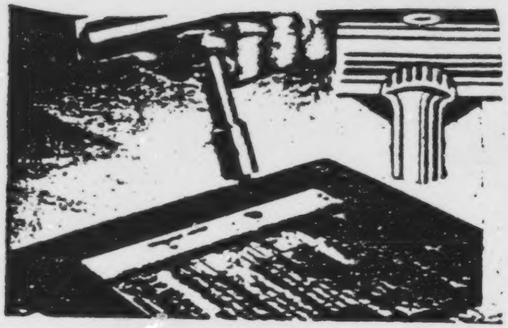
Padding Brush



Printer's Scale

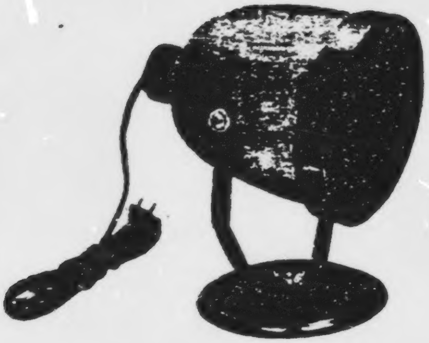


Ruler

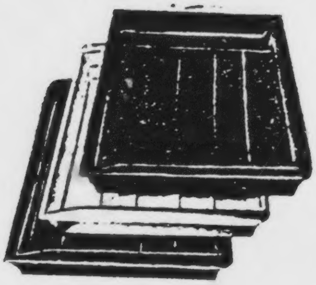


Key, Quoin, Chase

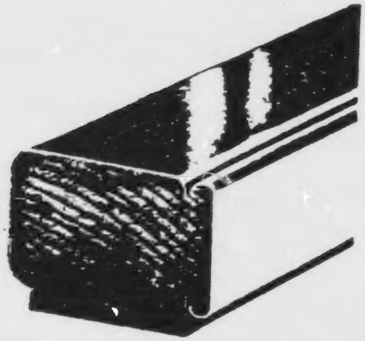
Thermometer



Safe Light



Developing Trays



Rubber Stamp Mounting Rule

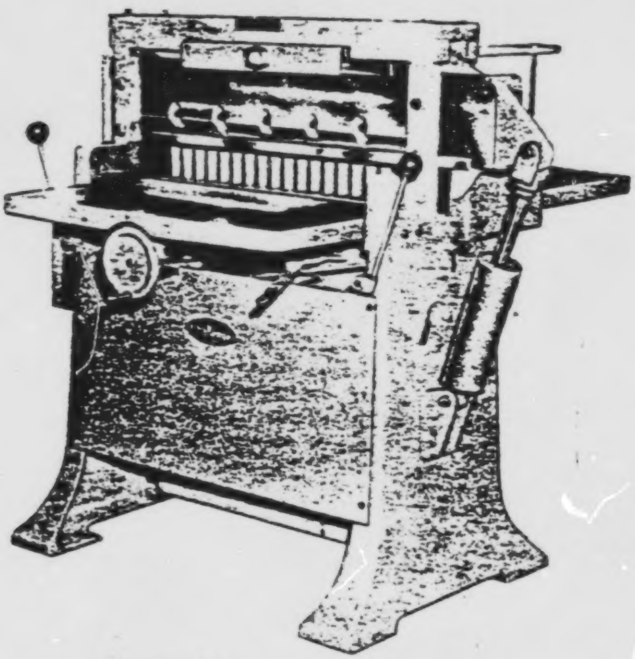
Thermostatic Water Supply Valve

Perforating Rule

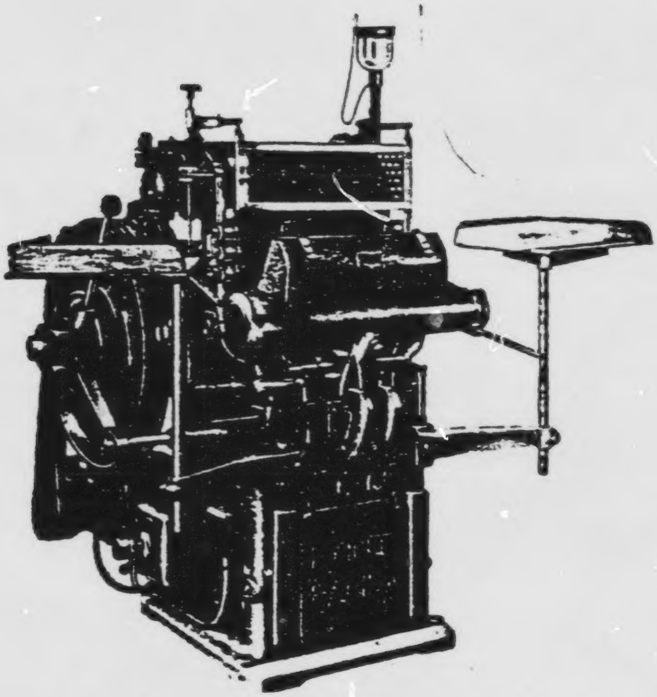
EQUIPMENT AND MACHINES

(Selected List)

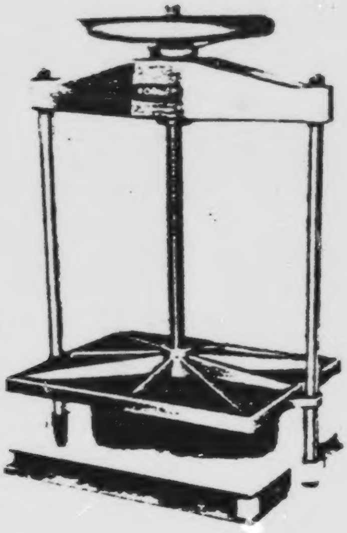
AB Dick Offset
Book Binding Press
California Job Case
Composing Stone and Wood Furniture
Electric Stapler
Eyelet Machine
Hand Waxer
Hydraulic Paper Cutter
Lead and Rule Cutter
Light Table
Numbering Machine
Paper Drill
Paper Folder
Plastic Punch and Bind Machine
Plate Maker
Platen Press
Print Enlarger
Proof Press
Rubber Stamp Machine
Strip Printer
Vertical Process Camera
Vibrating Table



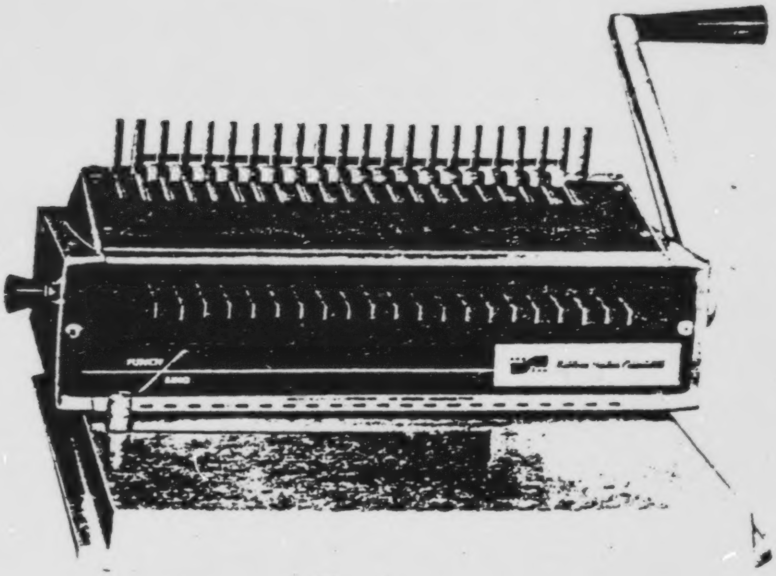
Hydraulic
Paper Cutter



Platen Press



Book Binding Press



Plastic Punch and Bind Machine

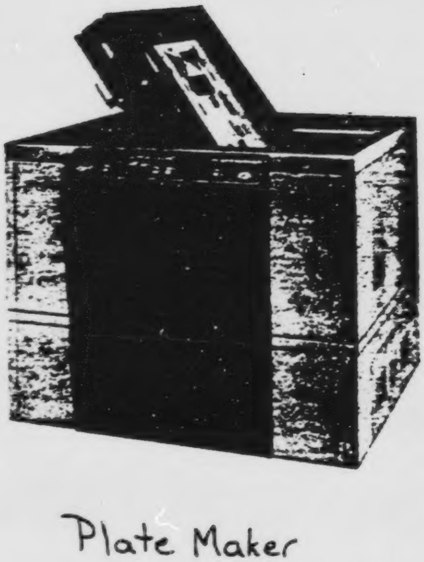
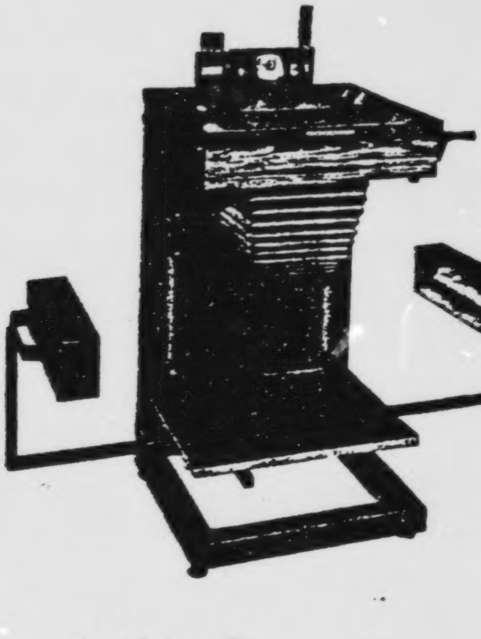
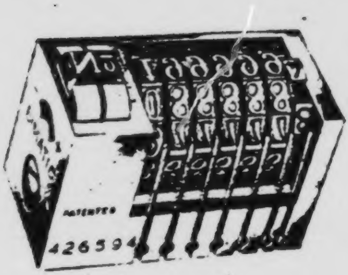


Plate Maker



Vertical Process Camera


PATENTED
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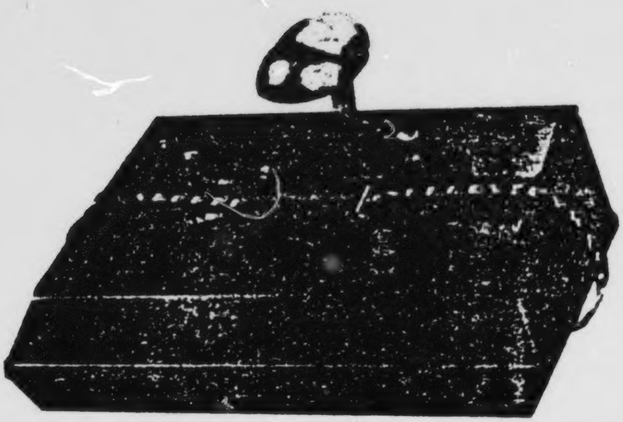
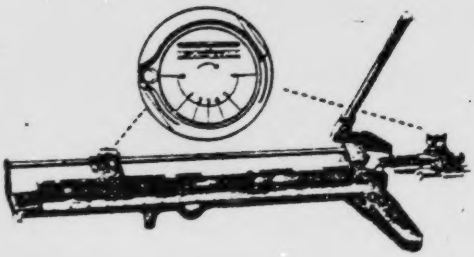
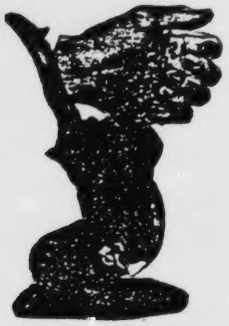
Numbering Machine



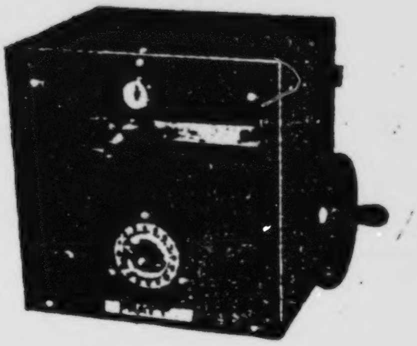
Strip Printer



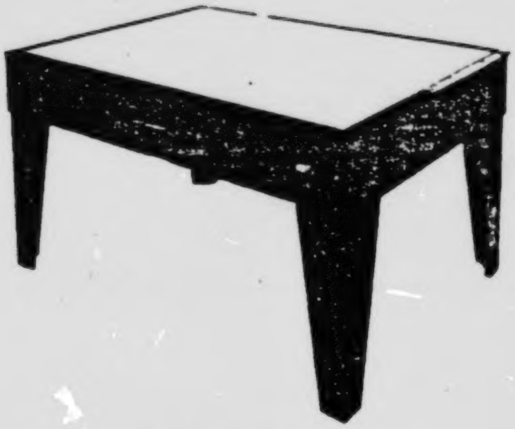
Lead & Rule Cutter



Eyelet Machine

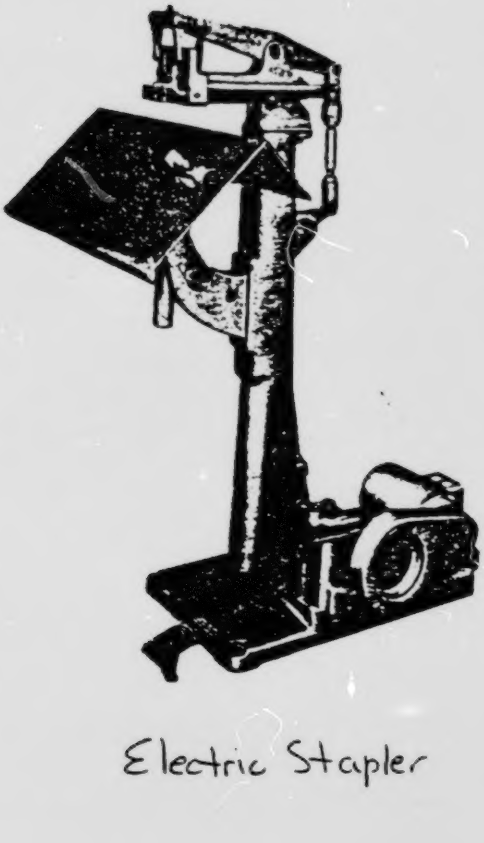


Rubber Stamp Machine

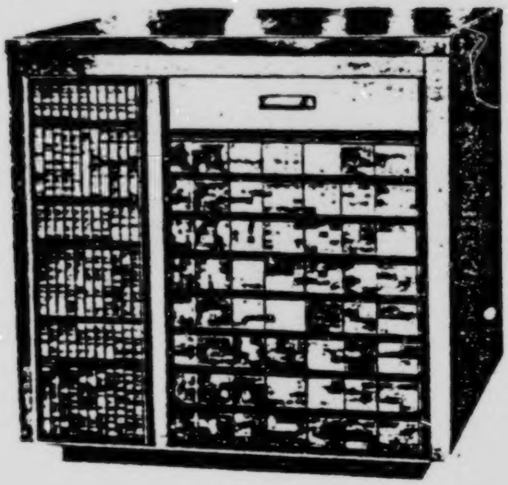


Light Table

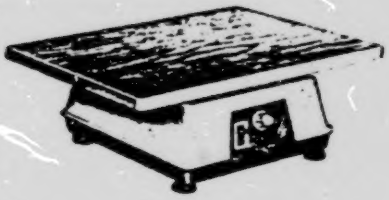
Paper Drill



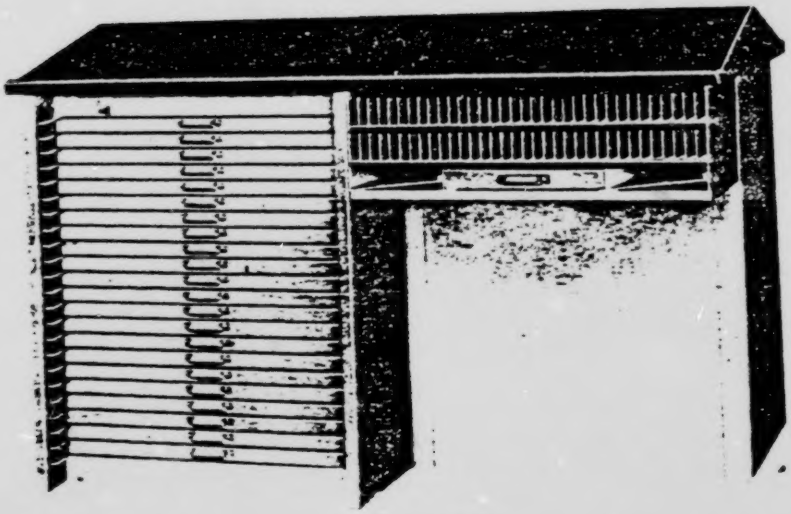
Electric Stapler



Composing Stone &
wood furniture

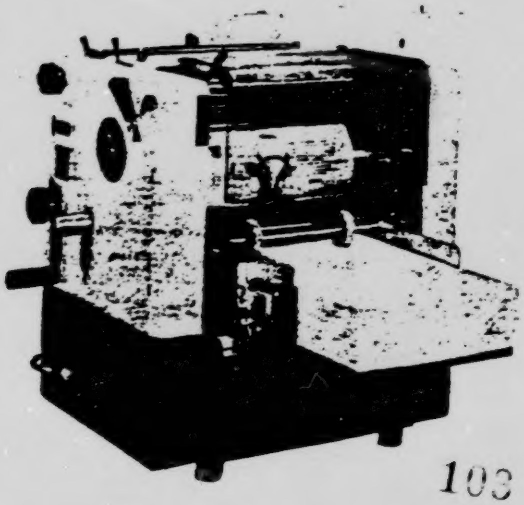


Vibrating Table

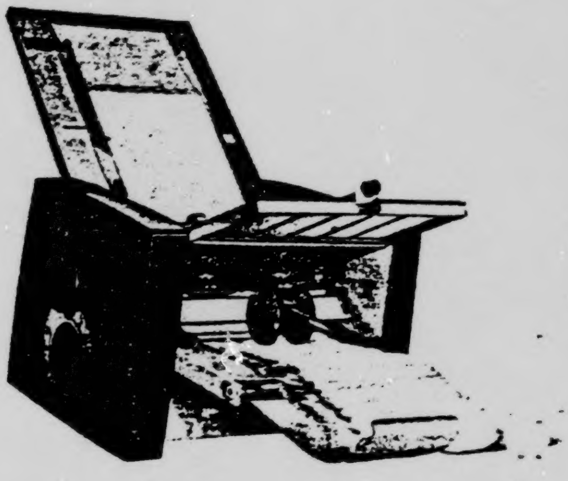


California Job Case

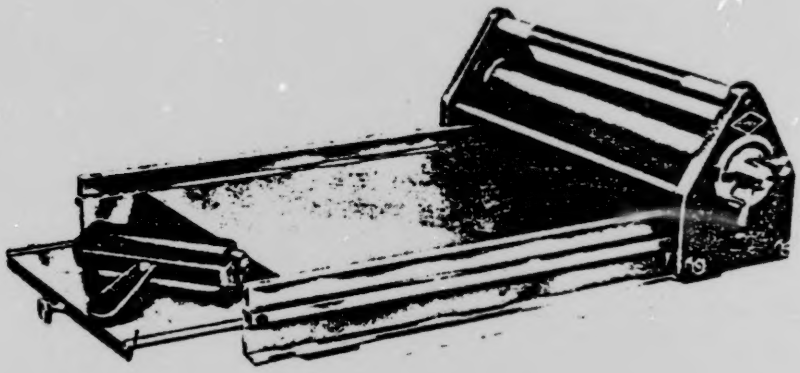
Print
Enlarger



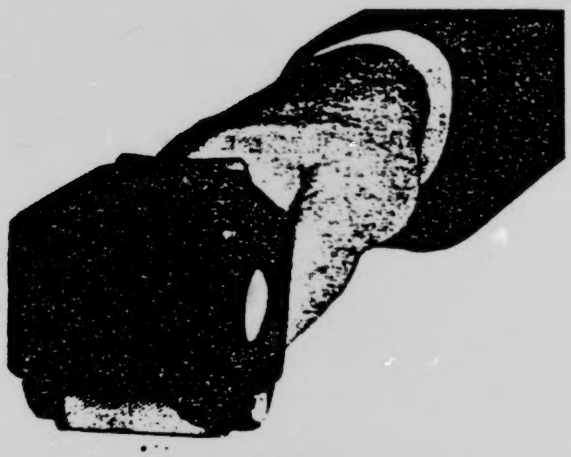
Offset Press



Paper Folder



Proof Press



Hand Waxer

Silk Screen Supplies

MATH SKILLS

1. WHOLE NUMBERS

A. Addition

- 2 digit addends with regrouping

B. Subtraction

- 2 digit subtrahend and minuend with regrouping

C. Multiplication

- 2 digit multiplicand and multiplier with regrouping

D. Division

- 2 digit dividend and divisor

2. FRACTIONS

A. identify fractions

B. adding simple fractions (ex. - 1/2 + 1/4)

C. subtracting simple fractions (ex. - 1/2 - 1/4)

D. multiplying simple fractions (ex. - 1/2 x 1/4)

E. dividing simple fractions (ex. - 1/2   1/4)

F. adding, subtracting, multiplying, dividing simple mixed fractions with whole numbers (2 digit)

3. MEASUREMENT

A. identify and measure on ruler - 1 inch, 1/2 inch, 1/4 inch, 1/8 inch, 1/16 inch

B. convert inches to points and picas
1 inch = 72 points   1 inch = 6 picas
1 pica = 12 points   1 pica = 1/6 inch

C. measure points and picas

4. MATH VOCABULARY

inch   point   pica

PRETEST

$$\begin{array}{r} 22 \\ \underline{+56} \end{array} \qquad \begin{array}{r} 39 \\ \underline{+17} \end{array} \qquad \begin{array}{r} 58 \\ \underline{-41} \end{array} \qquad \begin{array}{r} 86 \\ \underline{-49} \end{array}$$

$$\begin{array}{r} 15 \\ \underline{\times 8} \end{array} \qquad \begin{array}{r} 66 \\ \underline{\times 10} \end{array} \qquad \begin{array}{r} 32 \\ \underline{\times 47} \end{array}$$

$$2\overline{)38} \qquad 4\overline{)26} \qquad 20\overline{)84}$$

Add or Subtract These Fractions:

3/8 + 2/8 =　　1/2 + 3/4 =　　3 1/4 + 5/16 =

3/4 - 1/4 =　　7/16 - 3/8 =　　1 7/8 - 1/2 =

Multiply or Divide These Fractions:

5/8 x 3/8 =　　1/4 x 1/2 =　　2 3/4 x 1 1/8 =

3/4 ÷ 1/4 =　　23 ÷ 4 1/2 =　　17 ÷ 8 1/2 =

Measure These Lines With Your Ruler:

Using this formula convert inches, points, and picas.

1 inch = 72 points

1 inch = 6 picas

1 pica = 12 points

2 inches = ______ points   3 picas = _______ points

1 1/2 inches = _______ picas   2 1/4 picas = _______ points

36 points = _______ inches

Given a sheet of paper 12" x 20"; how many 6" x 10" sheets of paper can be obtained?

____

Given a sheet of paper 17" x 22"; how many 8 1/2" x 11" sheets of paper can be obtained?

____

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RELATED TEACHING AIDS

Filmstrips and Cassette Sets

1. McKnight Career Education; McKnight Publishers, 1976; Bloomington, Illinois.

   #7146 - The Process Lens
   Fundamentals of Process Photography

   #7151 - Lithographic Offset Press Cylinder Packing
   Offset Print Made Ready

   #7145 - Introduction to the Printing Process
   Basic Fundamentals of Photo Offset Lithography

   #7149 - Making a Single Color Halftone Negative
   Stripping and Platemaking Basic Procedures

   #7150 - Lithographic Offset Fundamentals
   Paper and Paper Cutting Calculations

   #7148 - Halftone Theory and Basic Photography Procedures
   Halftone Photography and Calibration of the
   Kodak Graphic Arts Exposure Computer

Vocational Filmstrips

1. The Library of Career Counseling Filmstrips, Counselor Films Inc., Career Future Inc., Philadelphia, Penn.

   Set 1 #1 The World Of Work

2. Career Exploration Series, ATC Publishers, Kankakee, Illinois.

   #409 - Printing Communications - 1

   A. Overview

   B. Pressman

   C. Graphic Arts Cameraman

D. Typesetter

E. Photoengraver

F. Stripper/Platemaker

(This set includes Career Interest Inventory and Rating Charts)

Vocational Film

1. Today's Newspaper Oxford Films
   1136 N. Las Palmas Ave.
   Los Angeles, California 90038
   (213) 461-9231

RELATED OCCUPATIONAL OPPORTUNITIES

Book Binder

Darkroom Technician

Graphic Layout and Design

Newspaper Production

Paper Cutter

Photographic Composition

Platemaker/Stripper

Press Operator

    Offset (Lithographic)   Letterpress

Printing Supply Sales

Process Cameraman

Silk-Screen Printing

Typesetter

SKILLS CHECKLIST

GRAPHIC ARTS

		EXCELLENT ABILITY	MODERATE ABILITY	LIMITED ABILITY
POSITION	stand *			
	sit *			
	lie			
	bend forward			
GROSS MOTOR	walk			
	push *			
	pull *			
	carry			
	lift (50 lb.)			
	limb flexibility *			
	hand-foot coordination *			
FINE MOTOR	eye-hand coordination *			
	hand-finger mobility *			
	eye-foot coordination *			
TACTILE	discrimination *			
VISUAL SKILLS	visual acuity *			
	color vision *			
	peripheral vision			
	memory *			
	discrimination *			
	figure ground			
	depth perception			
	spatial orientation *			
	directionality *			
AUDITORY SKILLS	hearing acuity			
	memory *			
	discrimination			
	figure ground (background noise) *			
LANG. & COMMUN.	following directions *			
	talk above background noise *			
SOCIAL	cooperation with instructor *			
	cooperation with peers *			
	working in a group situation *			
BEHAVIOR	attendance *			
	conduct *			
	attitude *			
	attention span *			
	respect for property *			
OTHER SKILLS				

METALWORKING

The metalworking program covers a wide variety of activities, including sheet metal forming, machining, welding, casting, and forging. Metalworking is enriched as students become interested in design, metallurgy, production techniques and instruments for exact measurements. The course provides experience in all areas of metalwork. Working from blueprints and accuracy of layout is stressed. The characteristics and uses of common metals are emphasized. Safety and proper work habits are also stressed.

GENERAL GOALS

1. The student will make practical application of Mathematics and Drawing.
2. The student will gain a working knowledge of metalworking tools and machines.
3. The student will be able to make simple machine setups skillfully and safely.
4. The student will gain an appreciation of appropriate design, sound construction, and quality workmanship.

AREAS COVERED IN METALWORKING

SHEET METAL - planning, layout and cutting, forming, assembling, finishing.

FORGING - planning, layout and cutting, forming, assembling.

WELDING - planning, layout, welding process.

FOUNDRY - planning, casting, moulding, finishing.

MACHINE SHOP - planning, forming, heat treating, finishing.

SAFETY PROCEDURES

1. Notify instructor immediately when injured.
2. Safety glasses, shields, etc., are mandatory at all times.
3. If oil or grease are spilled on the floor, clean it up immediately.
4. Place flammable materials in appropriate containers.
5. Do not operate machine without instructor's permission.
6. Do not operate equipment without prior instruction.
7. Never touch metal which you suspect is hot.
8. Do not touch moving parts of machines.
9. Approach people operating equipment cautiously.
10. Secure workpieces and cutting tools before turning on machines.
11. Do not leave a running machine unattended.
12. Remove metal chips from machine with a brush, stick, etc.
13. Do not stop equipment with your hand.
14. Return all tools and machine accessories to proper storage after use.
15. Use the correct tool for the job.
16. Clean tools before placing them in storage.
17. Check tools for sharpness, loose handles, etc., before use.
18. Carry tools with sharp edges downward.
19. Do not toss or throw tools.
20. Always report damaged tools to the instructor.

READING

Texts Used:

1. Modern Metalworking John Walker; Goodheart-Wilcox Publishers, 1973; South Holland, Illinois.

Readability Level: Approximately 11.5

Other Texts Used For Reference:

1. Modern Welding Andrew Althouse, William Bowditch, Carl Turnquist; Goodheart-Wilcox Publishers 1976; South Holland, Illinois.

Readability Level: Approximately 8.7

2. Sheet Metalwork Robert Smith; McKnight and McKnight Publishers, 1961; Bloomington, Illinois.

Readability Level: Approximately 9.2

3. Speedy - Melt - An Elementary Foundry Manual First edit., William Walter Sr., 1964; Revised edit., Fred T. Cowles, 1967; McEnglevan Heat Treating and Manufacturing Co., 1964; Danville, Illinois.

Readability Level: Approximately 9.5

4. Tools And Their Uses Prepared by: The U.S. Navy (Bureau of Naval Personnel); Dover Publications, 1973; New York, New York.

Readability Level: Approximately 6.5

Suggested Supplements:

1. Machine Technology Series - Video-texts

   A. Basic Machine Technology

   B. Milling and Tool Sharpening

   Joe Roberts Ph.D, Ted Saunders Ph.D; Cambridge Basic Skills Company (New York Times Co.) 1979; New York, New York.

Readability Level: Approximately 7.5

2. Shop Made Easy Frank Cattaneo, Frank E. Richards Publishers 1971; Phoenix, New York.

Readability Level: Approximately 6.5

3. The Basic Book of Metalworking Richard and Sherry Little; American Technical Society, 1979; Chicago, Ill.

Readability Level: Approximately 5.0

KEY WORD VOCABULARY

(Selected List)

ASSEMBLING
BENDING
BLUEPRINT
BOLTING
BRAZED JOINT
BUFFING
CASTING
CHAMFERING
CHIPPING
CORROSION
CUTTING
DRAWING
DRILLING
FACING
FASTENING
FILING
FINISHING
FORGING
FORMING
FOUNDRY
GRINDING
HARDENING
KNURLING
LACQUERING
LAYOUT
MELTING POINT
MILLING
MOULDING
PAINTING
PATTERN
POLISH
PRIMING
RIVET
SANDING
SHAPING
SKETCHING
SOLDERING
STAMPING
TAPERING
TEMPERING
WELDING

METALS

DEFINITIONS

Assembling (a sĕm′ bling) - putting a project together.

Bending (bĕnd′ ing) - to twist or turn.

Blueprint (blo͞o′ prĭnt) - blue copy of a drawing of an object to be made.

Bolting (bōlt′ ing) - using a nut and bolt to fasten objects.

Brazed Joint (brāzd joint) - (welding) - putting two pieces together with soft metal.

Buffing (bŭf′ fing) - cleaning off project with a machine.

Casting (căst′ ing) - (foundry) - an object made by pouring molten metal into a mold.

Chamfering (chăm′ fēr ing) - the rounding off of an edge.

Chipping (chĭp′ ing) - the breaking off of material in small pieces by a cutting tool.

Corrosion (kor ō′ zhon) - to wear away, to rust.

Cutting (kŭt′ ing) - dividing or removing material.

Drawing (draw′ ing) - a picture, usually done in pencil, showing something that is to be made.

Drilling (drĭll′ ing) - cutting round holes by a tool sharpened on its point.

Facing (fāc′ ing) - cleaning off a project with a grinding machine.

Fastening (făs′ n ing) - putting two objects together.

Filing (fīl′ ing) - removal of a material; scraping off with a file.

Finishing (fĭn′ ĭsh ing) - to complete a surface, as in polishing.

Forging (forj′ ing) - bending metal through heat.

Forming (form′ ing) - twisting and bending metal to form various shapes.

Foundry (foun′ drē) - heating metal and pouring it into a mold.

DEFINITIONS CONTINUED

Grinding (grīnd′ ing) - sharpening or smoothing by friction.

Hardening (hard′n ing) - heating process to strengthen metal.

Knurling (nerl′ ing) - surface with a rough edge to prevent slipping.

Lacquering (lăk′ ẽr ing) - painting a clear finish on an object.

Layout (lā′ out) - picture of what project you want to make.

Melting Point (mĕlt′ ing point) - the degree at which metal melts.

Milling (mĭl′ ing) - cutting metal with a certain machine.

Moulding (mōld′ ing) - to form and shape.

Painting (pānt′ ing) - using paint to stop corrosion on materials.

Pattern (păt′ ẽrn) - 3-D form of project but in paper form.

Polish (pŏl′ ish) - rubbing motion to smooth an object.

Priming (prīm′ ing) - painting on the first coat.

Rivet (rĭv′ ĕt) - metal bolt used to fasten two objects together by hammering the ends into heads.

Sanding (sănd′ ing) - smoothing an object.

Shaping (shāp′ ing) - forming metal by bending, twisting etc.

Sketching (skĕch′ ing) - free hand drawing of project to be made.

Soldering (sŏd′ ẽr ing) - a method used in joining metals together using melted lead.

Stamping (stămp′ ing) - pressing out a design.

Tapering (tāp′ ẽr ing) - to increase or decrease in size at an equal steady rate to make a cone-shape.

Tempering (tĕmp′ ẽr ing) - to make steel hard and strong.

Welding (wĕld′ ing) - using heat to transfer into a metal to put two pieces of metal together.

TOOLS

(Selected List)

Allen Wrench

Ball-peen Hammer

Box Wrench

C – Clamp

Center Guage

Chisel

Combination Set

Combination Square

Cut-off Saw

Depth Micrometer

Dial Caliper

Dial Indicator

Dividers

End Mill

Files

Hack Saw

High Speed Drill

Inside Caliper

Inside Micrometer

Open End Wrench

Outside Caliper

Outside Micrometer

Parallel Clamp

Protractor

Reamer

Screwdrivers

Surface Gauge

Tap Wrench

Taps

Telescoping Gauge

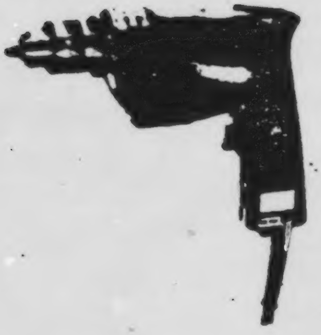
Thickness Gauge

Tool Bit

Trammel

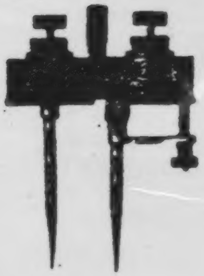
Vernier Caliper

Vise (machining and grinding)

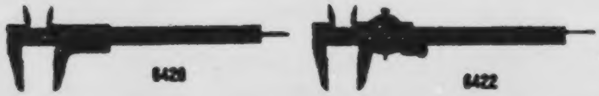


High Speed Drill

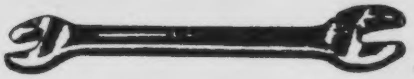
Hack Saw



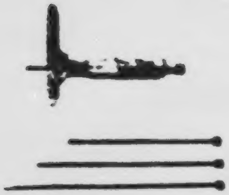
Trammel



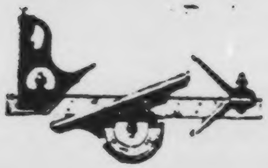
Vernier Calipers



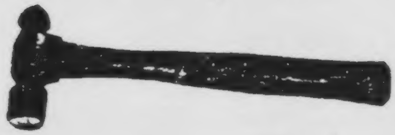
Open End Wrench



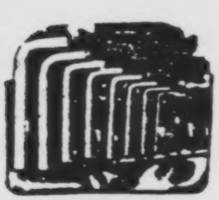
Depth Micrometer



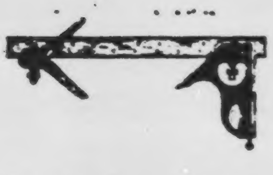
Combination Set



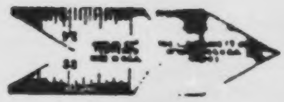
Ball-peen, Hammer



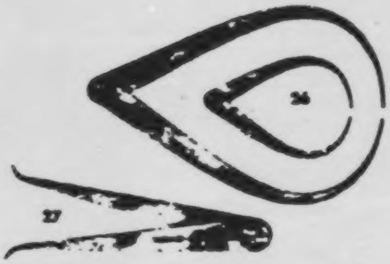
Allen Wrenches



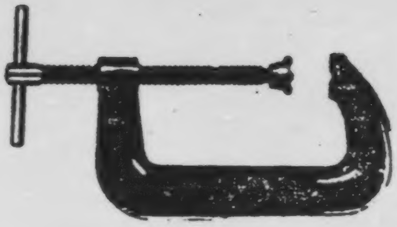
Combination Square



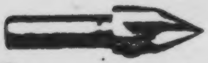
Center Gauge



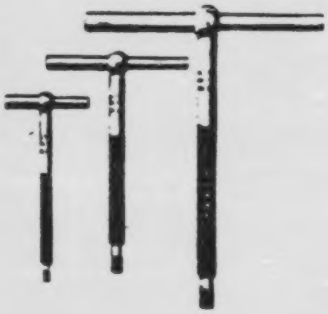
Outside Calipers
Inside Calipers



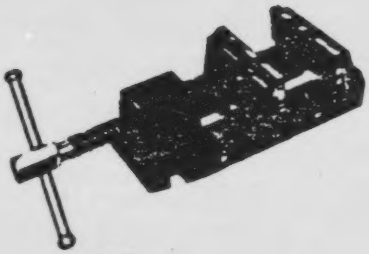
C'Clamp



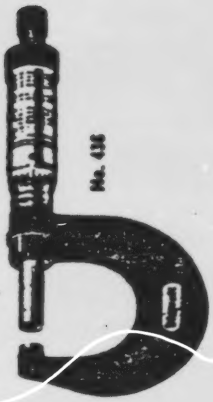
Reamer



Telescoping Gauges

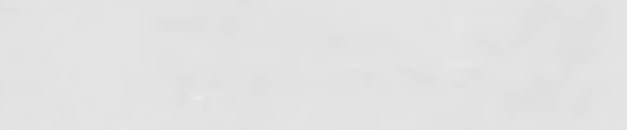


Vise

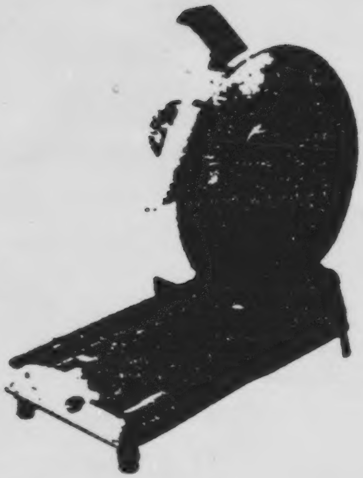


Micrometer

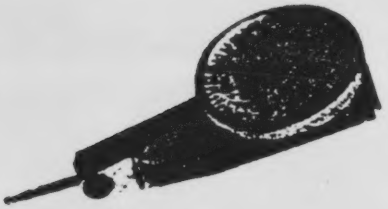
Dial Caliper


1
2
3
4
5
6
7
8
9
10

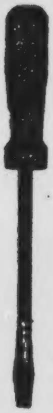
tool bits



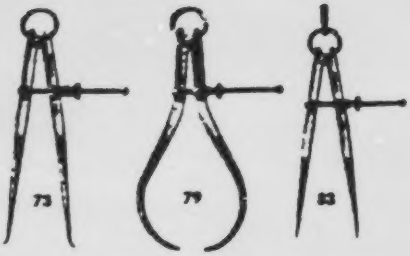
Cut-Off Saw



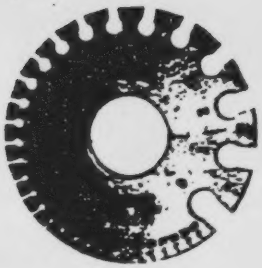
Dial Indicator



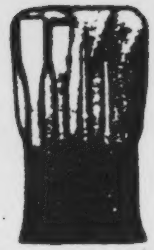
Screwdriver



Dividers

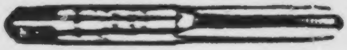


Thickness Gauge

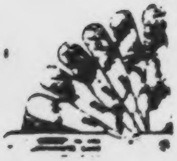


Chisels

End Mill



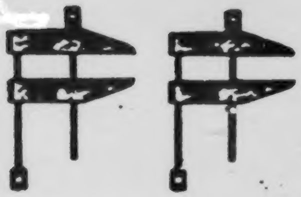
Tap


rom .0015 to .015 $4.

Thickness Gauges
(Feeler)

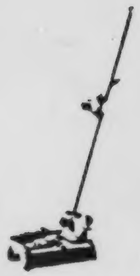
File

Box Wrench

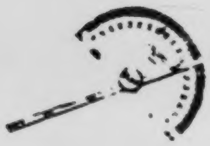


Parallel Clamps

Tap Wrench



Surface Gauge



Protractor

EQUIPMENT AND MACHINES

(Selected List)

Band Saw

Bench Grinder

Bending Machine

Box Brake

Cut-Off Saw

Drill Press

Gas Welder (Oxygen and Acetylene)

Heat Treat Furnace

Lathe

Melting Furnace

Mig Welder

Milling Machine (Horizontal)

Milling Machine (Vertical Bridgeport)

Shear Brake

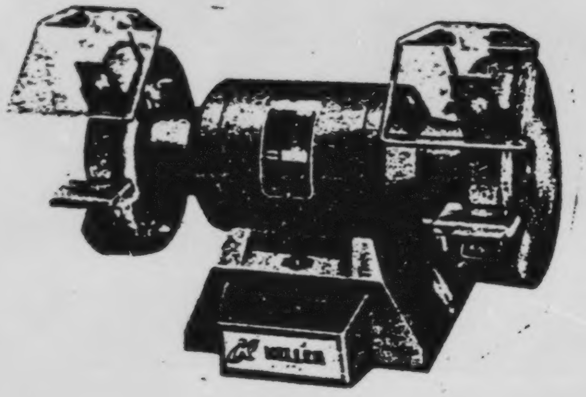
Slip Rolls

Soldering Furnace

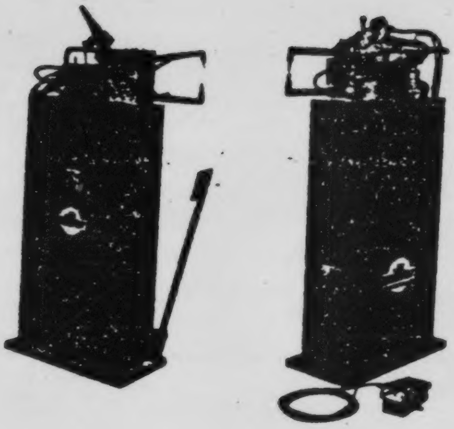
Spot Welder

Surface Grinder

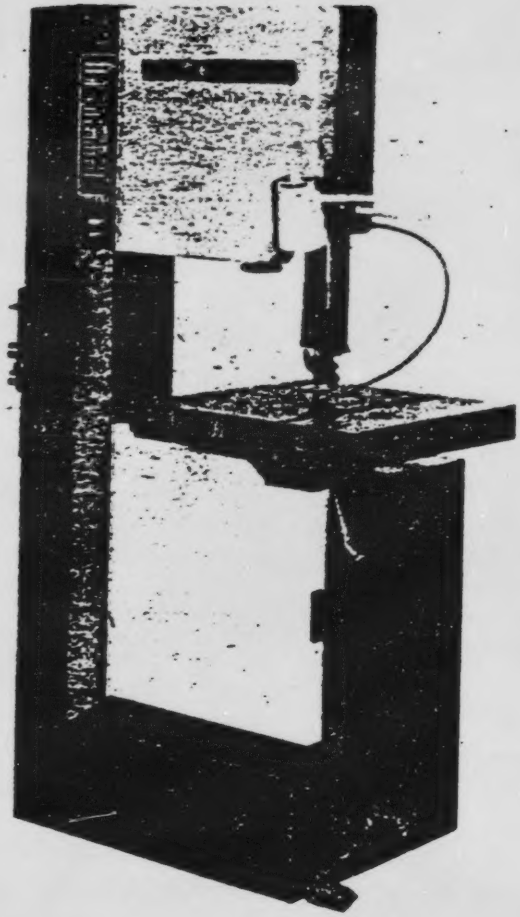
Tig Welder



Bench Grinder

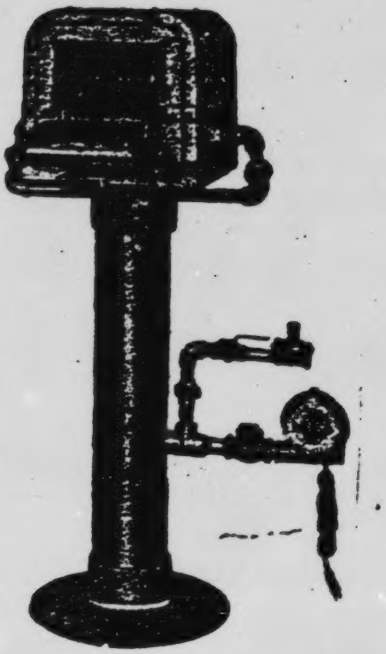


Spot Welder



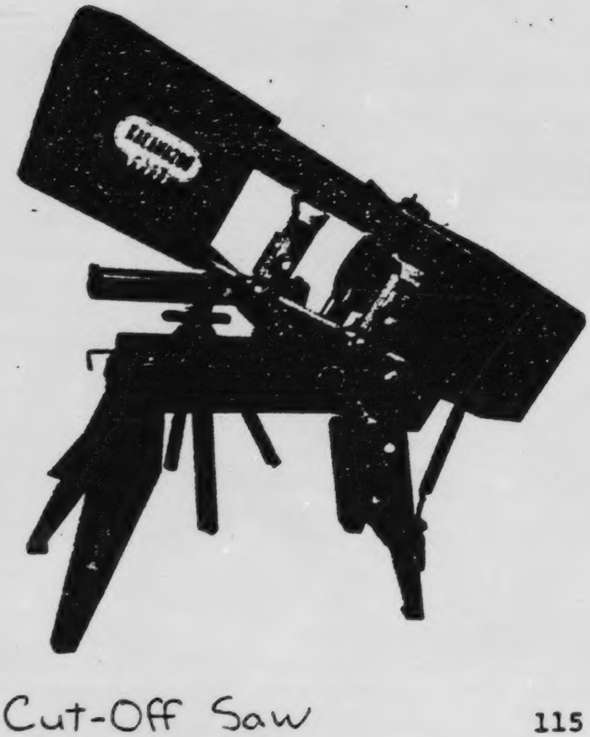
Band Saw

Tig Welder

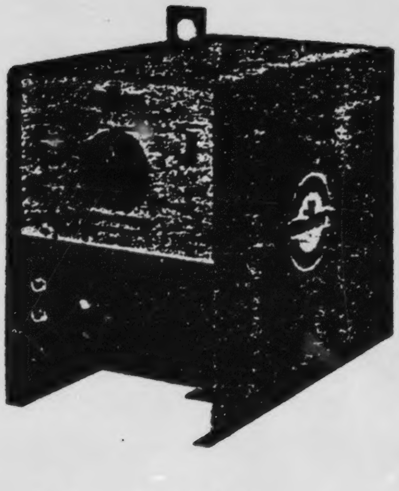


Heat Treat Furnace

Drill Press



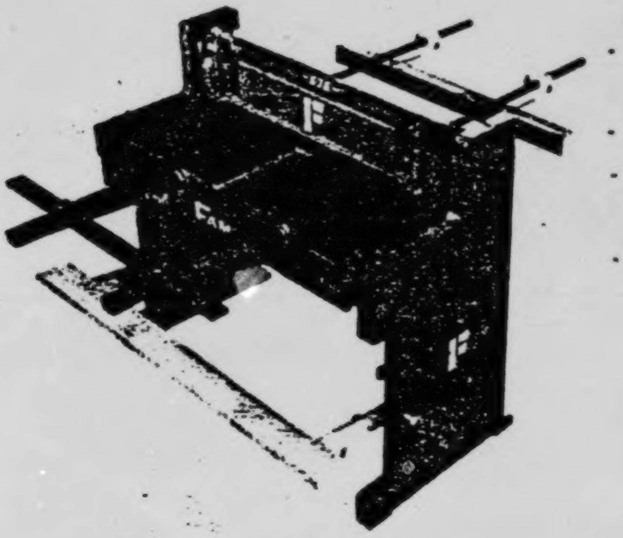
Cut-Off Saw



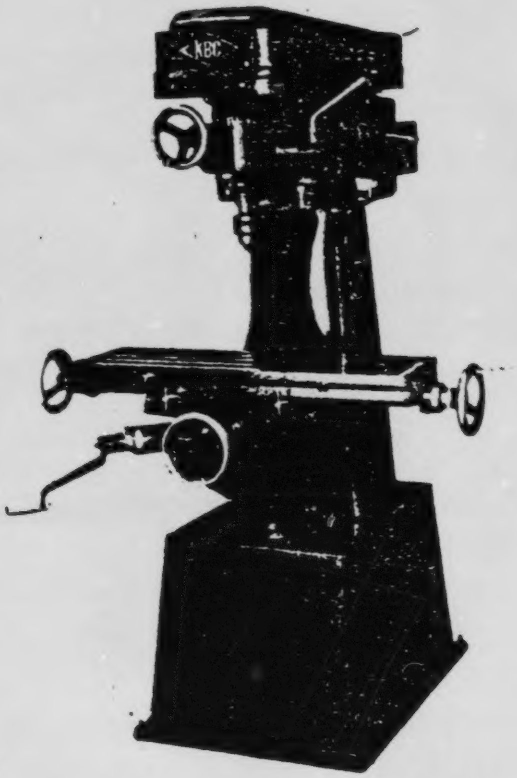
Mig Welder

Shown with optional stand

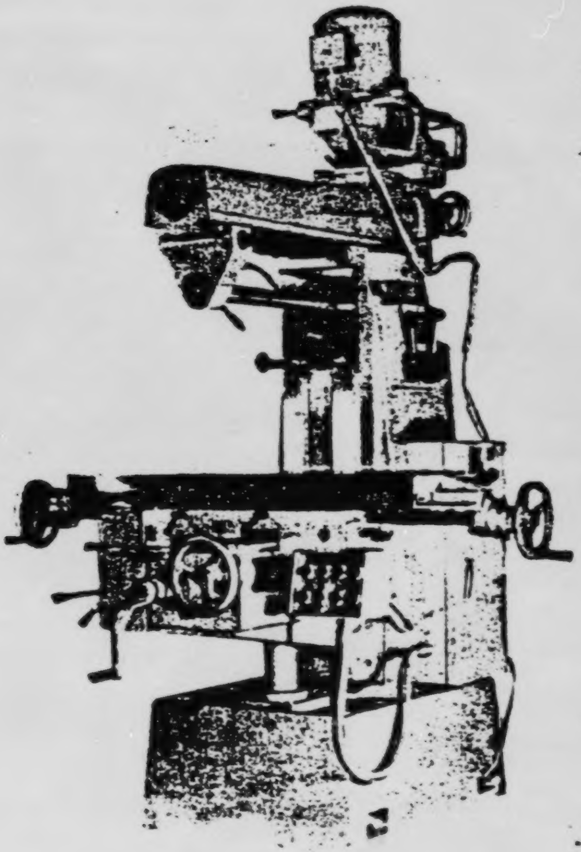
Slip Rolls



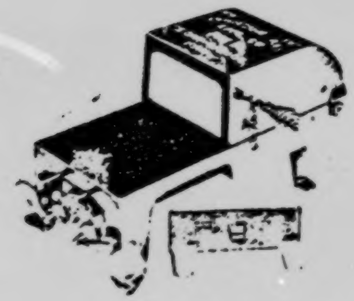
Shear Brake



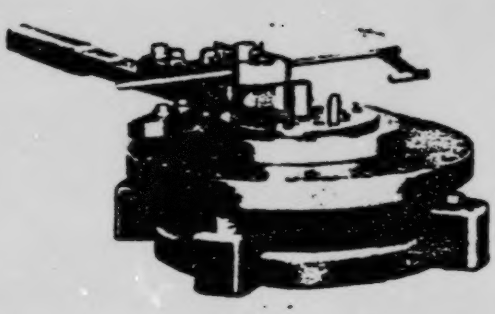
Vertical Milling Machine 129



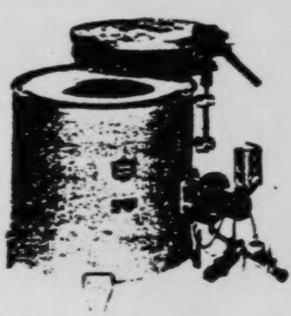
Horizontal Milling Machine



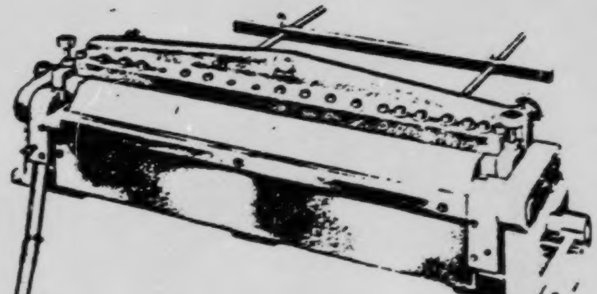
Soldering Furnace



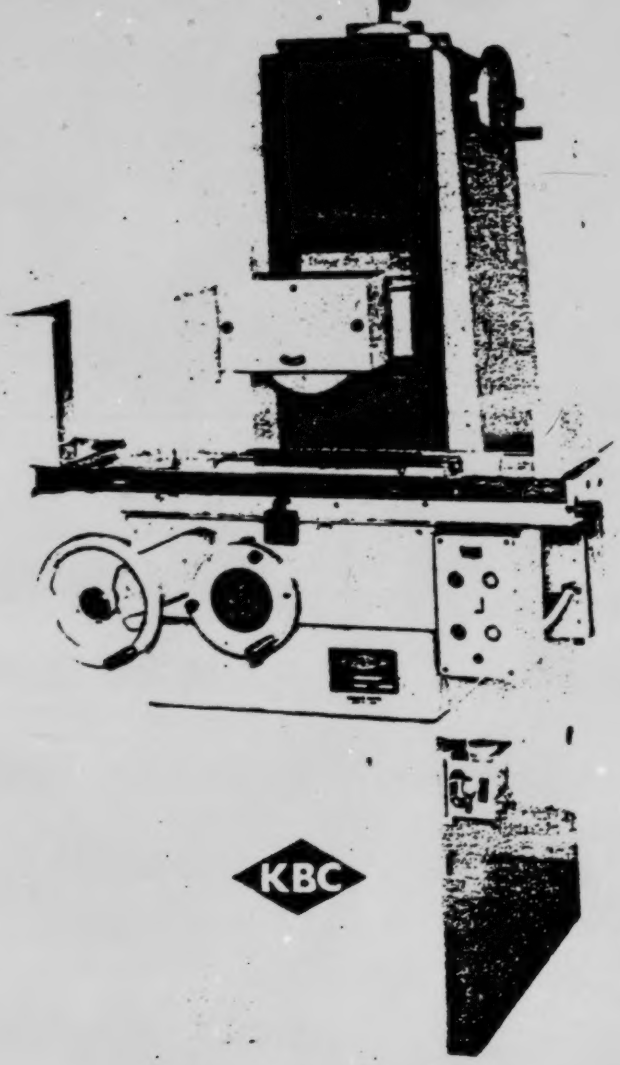
Bending Machine



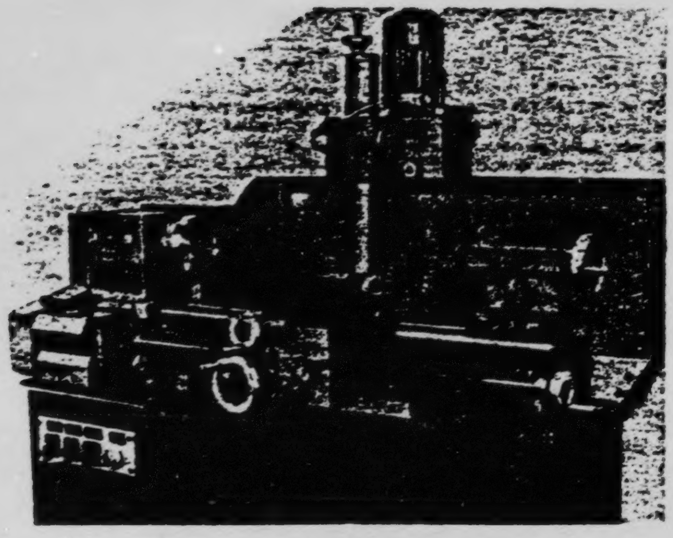
Melting Furnace



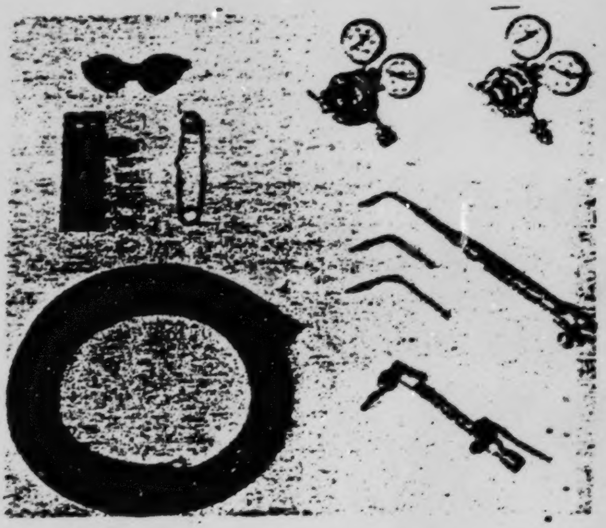
Box Brake



Surface Grinder



Lathe



Gas Welder

MATH SKILLS

1. **WHOLE NUMBERS**
    - A. **Addition**
        - 4, 5 digit addends with regrouping
    - B. **Subtraction**
        - 4, 5 digit subtrahend and minuends
    - C. **Multiplication**
        - 5 digit multiplicand by 3 digit multiplier
    - D. **Division**
        - 5 digit dividend by 2 digit divisor
    - E. **Place Value of Whole Numbers**
        - units and tens

2. **DECIMALS**
    - A. identify place value to .0001
    - B. addition of 1-5 digit addends with regrouping
    - C. subtraction of 1-5 digit subtrahends and minuends with regrouping
    - D. multiplication of 4 digit multiplicand and two digit multiplier
    - E. multiplication of decimals with 0 in the answers
    - F. division of 4 digit dividend with decimal by a 2 digit whole number divisor
    - G. division of a 4 digit dividend with decimal by 2 digit divisor with decimal
    - H. division of decimals with 0 in the answer

3. FRACTIONS

A. identifies fractions

B. conversion of fractions to decimals

C. equivalent fractions - reducing - in higher terms

D. conversion of mixed number to an improper fraction (and vise-versa)

E. addition of fractions

F. division of fractions in 1/2

4. MEASUREMENT

A. measurement to the inch, 1/2 inch, 1/4 inch, 1/8 inch, 1/16 inch

B. conversion of feet to inches and inches to feet

C. adding inch, 1/2 inch, 1/4 inch, 1/16 inch, etc.

5. MATH VOCABULARY

length

width

height

diameter

radius

inch

feet

denominator

numerator

PRETEST

864 +225	1431 +7256	604 +598	3872 +9088
649 -243	4958 -1532	714 -357	7096 -1869
75 x 6	586 x23	2479 x152	30516 x 307

Fill in the missing numbers: 25, _____, ______, 100.

$3\overline{)735}$	$12\overline{)180}$	$7\overline{)2685}$	$26\overline{)38197}$

Identify in written form:

.015 - ____________________ .625 - ____________________

.0001 - ____________________ .0758 - ____________________

.1328 +.6251	.34860 +.69257	.9386 -.4250	.68493 -.37258

Subtract: 8.960 - .584 3.061 - .0482

$$\begin{array}{r} .0412 \\ \times\ .28 \\ \hline \end{array} \qquad\qquad \begin{array}{r} .1352 \\ \times\ 40 \\ \hline \end{array}$$

$$15\,\overline{)\,.2085} \qquad\qquad .36\,\overline{)\,4.628} \qquad\qquad .57\,\overline{)\,3.645}$$

Circle which is larger:

.50 or .15

.343 or .048

.0025 or .0150

.075 or 1/2

.0625 or 1/8

Change these fractions to decimals:

1/2 =   3/4 =   2 1/8 =   4 1/16

Change these decimals to fractions:

.50 =   .125 =   .750 =

Reduce to lowest terms:

$$\frac{10}{20} \qquad \frac{4}{16} \qquad \frac{15}{45} \qquad \frac{20}{64}$$

$$\frac{1}{2} = \frac{?}{4} \qquad \frac{7}{8} = \frac{?}{16} \qquad \frac{1}{16} = \frac{?}{32}$$

Change these mixed numbers to improper fractions:

2 1/2 =   4 1/16 =   3 7/8 =   7 3/16 =

Add these fractions: **Reduce to lowest terms.**

1/4 + 3/4 =   1 3/8 + 5/8 =   1 1/2 + 3/4 =

A 1/2" drill has a _______________ radius.

A 5/8" drill has a ___________________ diameter.

A circle has ___________ degrees.

Measure these lines with your ruler:

____

____

____

2 feet = ________ inches   3 1/2 feet = _________ inches

13 inches = ____________________

RELATED TEACHING AIDS

Filmstrips and Cassette Sets

1. Berwall Productions; Garden City, New York
    - A. Non Fusion Welding Exploration
    - B. Fusing Welding Exploration
    - C. Bench Metalwork
    - D. The Lathe Explained
    - E. Art Metalwork
    - F. Sheet Metalwork
    - G. Foundry Work
    - H. The Grinding Machine
    - I. The Milling Machine Exploration
2. ACI Productions; New York, New York
    - A. Oxy. Acetylene Welding
    - B. Elementary Engine Lathe

Posters and Charts

1. Starret (L.S. Starret Co.; Athol, Mass.)
    - A. Decimal Equivelents and Tap Drill Sizes
    - B. Inches to Millimeters
    - C. Precision Tool Chart

Workbooks

1. General Shop Safety Rules (duplicating masters)
2. Personal Safety, Milliken Press Pub., 1975.

Vocational Filmstrips

1. The Library of Career Counseling Filmstrips, Counselor Films Inc., Career Future Inc., Philadelphia, Penn.

Set 1	#1	The World of Work
Set 2	#1	Is a Career in Machining For You?
Set 9	#2	Is a Career in Bench Work For You?
	#4	Is a Career in Iron and Steel For You?

RELATED OCCUPATIONAL OPPORTUNITIES

Sheet Metal Industry

- Metalsmith
- Helper
- Machine Operator
- Construction Metalworker
- Aircraft Metalworker

Welding

- Welder

Foundry

- Pattern Maker
- Foundry Man

Machine Industries

- Mass Production
- Machine Set-Up
- Operation and Maintenance

- Machinist
- Tool Maker
- Tool Designer
- Heat Treater

- Helper
- Apprentice
- Journeyman

SKILLS CHECKLIST

METALWORKING

		EXCELLENT ABILITY	MODERATE ABILITY	LIMITED ABILITY
POSITION	stand *			
	sit			
	lie			
	bend forward			
GROSS MOTOR	walk *			
	push *			
	pull *			
	carry *			
	lift (50 lb.) *			
	limb flexibility *			
	hand-foot coordination			
FINE MOTOR	eye-hand coordination *			
	hand-finger mobility *			
	eye-foot coordination *			
TACTILE	discrimination			
VISUAL SKILLS	visual acuity *			
	color vision			
	peripheral vision *			
	memory *			
	discrimination *			
	figure ground			
	depth perception			
	spatial orientation			
	directionality *			
AUDITORY SKILLS	hearing acuity *			
	memory			
	discrimination			
	figure ground (background noise) *			
LANG. & COMMUN.	following directions *			
	talk above background noise *			
SOCIAL	cooperation with instructor *			
	cooperation with peers *			
	working in a group situation *			
BEHAVIOR	attendance *			
	conduct *			
	attitude *			
	attention span *			
	respect for property *			
OTHER SKILLS				

POWER MECHANICS

Power Technology is a field of study encompassing one factor that affects our society. That factor is power. The study of power is the study of the total system: from the sources of energy, through power producing machines. This unit deals primarily in the area of power mechanics and the automobile.

Excellent opportunities are provided for the development of problem solving abilities while working with tools, materials and procedures related to power development and use in its many useful forms.

GENERAL GOALS

1. Students will acquire an understanding of scientific mechanical principles involved in units of power generation and consumption.
2. Students will gain knowledge in the use of automotive service tools and test equipment.
3. Students will develop sound work habits and the ability to work together as a group.
4. Students will become familiar with occupational opportunities in the many fields of manufacturing and servicing.

AREAS COVERED IN POWER MECHANICS

1. Orientation - shop practices and safety
2. Basic Electricity and Magnetism

THE AUTOMOBILE

3. Basic Ignition System - components, operation, troubleshooting
4. Tune Ups - use of electronic tune up machine, components and parts in tune ups; distributor, troubleshooting
5. Brake System - basic operation types of brakes, troubleshooting
6. Fuel and Exhaust System - basic operation, components. troubleshooting
7. Steering and Suspension System - components, operation, troubleshooting the front end

SAFETY PROCEDURES

1. Notify instructor immediately when an injury occurs.
2. Safety glasses, shields, etc., are mandatory at all times.
3. If oil or grease are spilled on the floor, clean it up immediately.
4. Handle flammable materials with care and caution.
5. Do not operate equipment without prior instruction and instructor's permission.
6. Approach people operating equipment cautiously.
7. Keep hands, tools, cards, etc., away from the automobile's fan.
8. Remove the cap from the radiator of a pressurized system with extreme caution.
9. Keep all sparks, heat and open flames away from an automobile's gas tank.
10. Never place your hand over the air horn of a carburator to coke an engine.
11. Make sure all lift equipment is in good operating condition.
12. Never work on a clutch assembly without first disconnecting the battery.
13. Block an automobile safely when tires are removed and you must work under the auto.

14. Secure wheel lugs tight when changing tires.

15. When using all wrenches, pull -- do not push.

16. Return all tools and machine accessories to proper storage, after use.

17. Do not toss or throw tools.

18. Always report damaged tools or equipment to the instructor.

READING

Texts Used:

1. Auto Mechanics Fundamentals Martin Stockel; Goodheart-Wilcox Publishers, 1978; South Holland, Illinois.

Readability Level: Approximately 9.5

2. Power: Mechanics of Energy Control R. Bohn, A. J. McDonald; McKnight & McKnight Publishers, 1970; Bloomington, Illinois.

Readability Level: Approximately 10.5

3. Small Gasoline Engines G. Stephenson; Delmar Publishers, 1978; Albany, New York.

Readability Level: Approximately 11.0

Suggested Supplements:

1. The Basic Book of Power Mechanics Jay Webster; American Technical Society, 1979; Chicago, Illinois.

Readability Level: Approximately 8.0

2. Career Education - Automotive (Workbook in Spanish and English), Vocational Technical Series: F. Bond, E. Cash, R. Reynolds Jr.; Allied Educational Council; Distribution Center, 1972; Galien, Michigan.

Readability Level: Approximately 6.5

3. You Can Be A Mechanic Arthur Liebers; Lothrop, Lee & Shepard Co., 1975; New York, New York.

Readability Level: Approximately 5.0

4. The Vermont Guide For Teaching Adolesents With Special Needs - Curriculum Guide, c/o Special Education Resource Center (Auto Mechanics, pp. 308-327) Hartford, Connecticut.

5. Automobile Maintenance Reading And Language Activities William Kessman; c/o Minnesota Instructional Materials Center; White Bear Lake, Minnesota.

6. Auto Body: An Adaptive and Developmental Program for Special Needs Students, Thomas DiTaranto; c/o Minnesota Instructional Materials Center; White Bear Lake, Minnesota.

7. Vocabulary Skills Booklets - Auto Shop Virginia Tracy; c/o Voc-Tech Curriculum Lab, Rutgers University, New Brunswick, New Jersey.

KEY WORD VOCABULARY

(Selected List)

ACCELERATE
ALIGNMENT
ATOM
BLEEDING BRAKES
CALIBRATE
COMBUSTION
COMPRESSION
CURRENT
COUNTER BALANCE
ELECTRON
ELEMENT
ENERGY
FLOODING
FRICTION
FUEL EFFICIENCY
FUEL INJECTION
GEAR RATIO
GRAVITY
HEAT RANGE
HORSEPOWER
HYDRAULIC
LOAD RANGE
OIL VISCOSITY
NEUTRON
PLY RATING
PROTON
RESISTANCE
TIRE ROTATION
TOLERANCE
TORQUE
VOLTAGE

POWER MECHANICS

KEY WORD DEFINITIONS

Accelerate (ăk sĕl′er āt) - to increase speed.

Alignment (ə līn′mĕnt) - bringing parts together to correct their positions.

Atom (ă′tŭm) - smallest part of an element that can exist alone.

Bleeding Brakes (blēd′ing brāks) - removal of air by forcing brake fluid from master cylinder through the lines.

Calibrate (kăl′ĭ brāt) - adjusting dial needle to correct load setting.

Combustion (kŭm bŭs′chən) - process involved in burning.

Compression (kŭm prĕ′ shŭn) - applying pressure to a spring.

Current (ker′ ĕnt) - electrons in motion - the unit is called the ampere.

Counter Balance (kount′ er băl′əns) - weight attached to some moving part so it will be in balance.

Electron (ē lĕk′ trŏn) - tiny particle with a negative charge that makes up an atom.

Element (ĕl′ ĕ mĕnt) - substance that cannot be broken down by ordinary means.

Energy (ĕn′ er jē) - capacity for doing work, vigor of action.

Flooding (flod′ ing) - condition where fuel mixture is overly rich or much has reached the cylinders.

Friction (frĭk′ shŭn) - resistance of movement between two objects.

Fuel Efficiency (fū′ĕl ē fĭsh′ ĕn sē) - method of fuel injection for better mileage.

Fuel Injection (fūĕl ĭn jĕk′ shŭn) - fuel system that uses no carbureter, but sprays fuel in cylinders or intake manifold.

Gear Ratio (gear rā′ shē ō) - relationship of turns, of one gear to another.

Gravity (gră′ vĭ tē) - the pull of the earth on an object.

Heat Range (hēt rānj) - operating temperature of a spark plug.

Horsepower (hors pow′ er) - measurement of engine′s ability to perform work.

Hydraulic (hī draw′ lĭk) - fluids in motion.

Load Range (lōd rānj) - used to indicate tire load and inflation limit.

Oil Viscosity (oil vĭs kŏs′ ĭ tē) - thickness of oil.

Neutron (new′ trŏn) - tiny particle of an atom that has no charge.

Ply Rating (plī rāt′ ing) - tire strength, load carrying capacity.

Proton (prō tŏn) - tiny particle with a positive charge - makes up an atom.

Resistance (rē sĭs′ tĕnts) - ability to slow down the flow of electricity.

Tire Rotation (tīr rō tā′ shŭn) - moving front tires to rear and rear tires to front to equalize wear.

Tolerance (tŏl′ er ənts) - allowance when measuring metal pieces.

Torque (tork) - turning or twisting force.

Voltage (vōl′ təj) - electrical force that pushes current through circuit.

TOOLS

(Selected List)

ADJUSTABLE WRENCH

AIR IMPACT WRENCH

AIR JACK

AIR WRENCH

ALLEN WRENCH

ANTIFREEZE TESTER

ASSORTED IMPACTED TOOLS

BATTERY FILLER

BATTERY TERMINAL PULLERS

BATTERY TESTER

BLACKSMITH HAMMER

BOX WRENCH

BRAKE ADJUSTING TOOL

BRAKE SHOE RETAINING SPRING TOOL

BRAKE SPRING PLIERS

BRAKE SPRING TOOL

CAN POURING SPOUT

CHAIN HOIST

CHISELS

COMBINATION FLARE NUT WRENCHES

COMBINATION WRENCH

COMPRESSOR TESTER

CREEPER

DEAD BLOW HAMMER

DISC BRAKE MICROMETER

DISC BRAKE ROTOR THICKNESS GAGE

DRILLS

DWELL AND TACHOMETER

FEELER GAGE

FLEX HEAD RATCHET

FLEXIBLE HANDLE

FUNNEL

GREASE GUN

HYDRAULIC JACK

JACK STAND

NEEDLE NOSE PLIERS

OIL DRAIN PAN

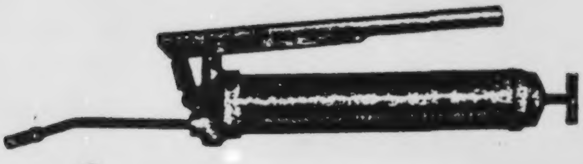
OIL FILTER WRENCH

OPEN END WRENCH

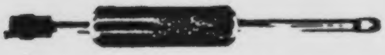
OVERHEAD LIGHT

PHILLIPS HEAD SCREWDRIVER

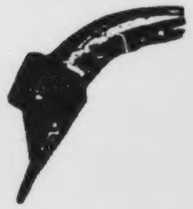
PLIERS
POWDER DRILL
PRICK PUNCH
PUNCH AND CHISEL HOLDER
RADIATOR FILL
REVERSIBLE RATCHET
RIB JOINT PLIERS
ROTO RATCHET
SCREWDRIVER
SOCKET DRIVE ADAPTORS
SOCKET EXTENSION
SOCKETS
SPARK PLUG SOCKET
SPEED HANDLE
SPINNER HANDLE
THUMB WHEEL RATCHET
TIMING LIGHT
TAP AND DIE SET
TORQUE WRENCH
TUBE TESTING TANK
UNIVERSAL SOCKETS
VACUUM TESTER
VALVE SEAT GRINDER
WELDING GLOVES
WELDING HELMET
WHEEL PULLERS
WHEEL WEIGHT PLIERS
WIRE CUTTING PLIERS



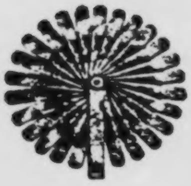
Grease Gun



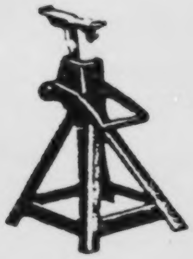
Brake Spring Tool



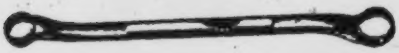
Can Pouring Spout



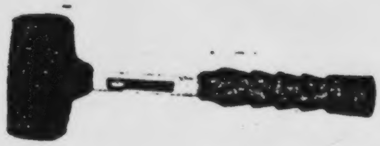
Feeler Gage



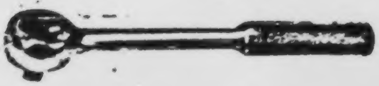
Jack Stand



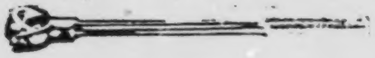
Box Wrench



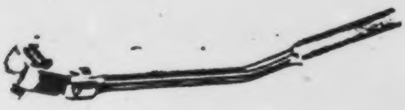
Dead Blow Hammer



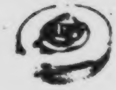
Reversible Ratchet



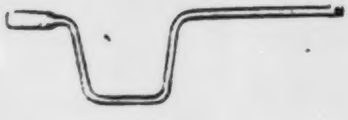
Roto Ratchet



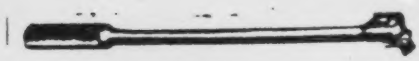
Flex Head Ratchet



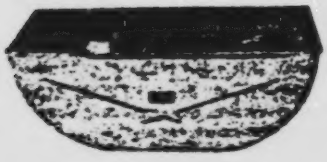
Thumb Wheel Ratchet

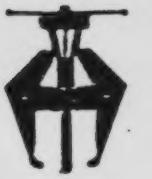


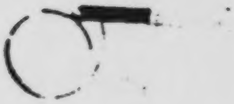
Speed Handle

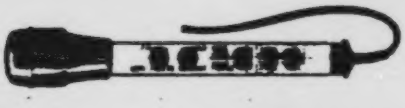


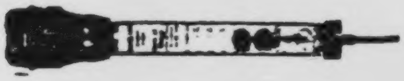
Flexible Handle

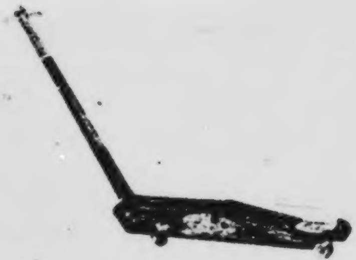

Tube Testing Tank

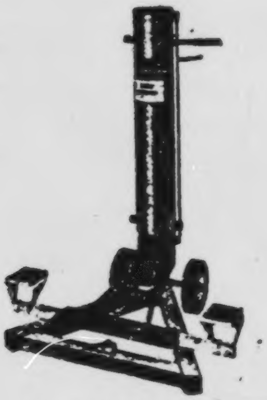

Battery Terminal Pullers

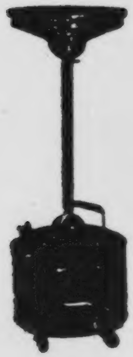

Oil Filter Wrench

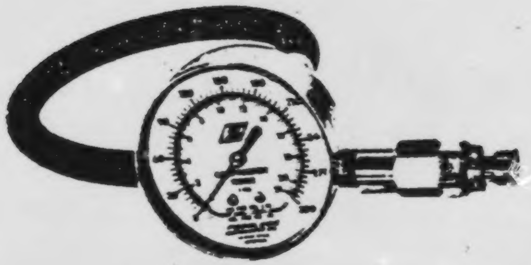

Anti freeze Tester

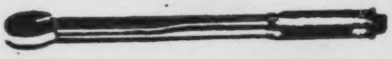

Battery Tester

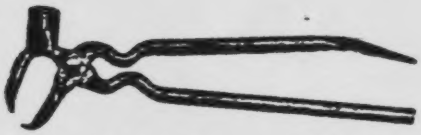

Hydraulic Jack


Air Jack


Oil Drain Pan

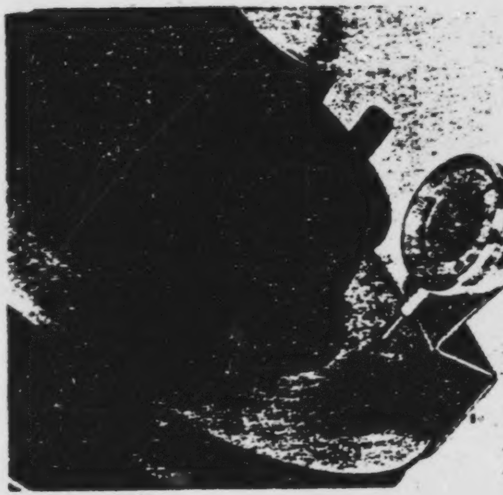

Compression Tester


Torque Wrench


Wheel Weight Pliers

Chain Hoist

Disc Brake Micrometer

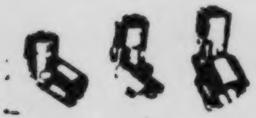


Disc Brake Rotor Thickness Gage

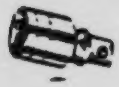
Timing Light

Overhead Light

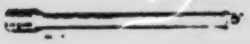
Vacuum Tester



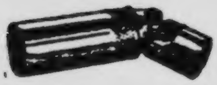
Universal Sockets



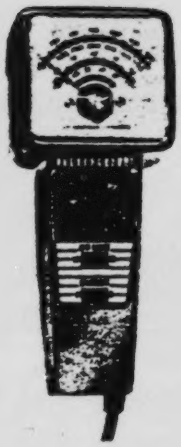
Socket Drive Adaptors



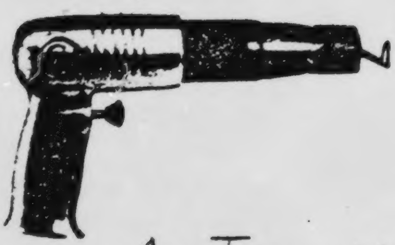
Socket Extension



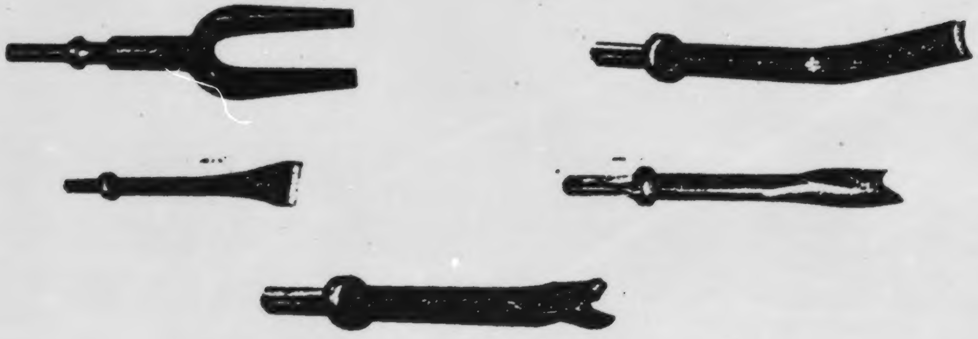
Spark Plug Socket



Dwell and Tachometer

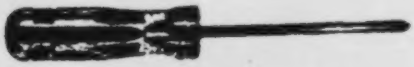


Air Impact Wrench

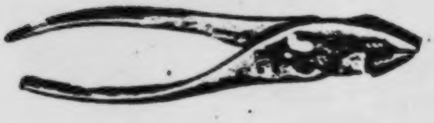


Assorted Impact Tools

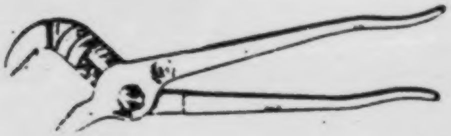
Screwdriver



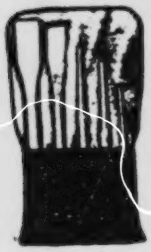
Philips Head Screwdriver



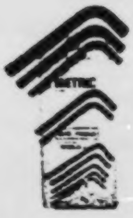
Pliers



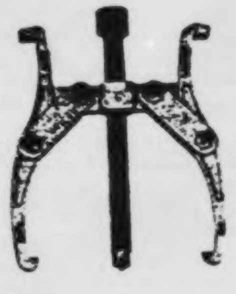
Rib Joint Pliers



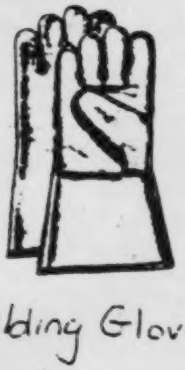
Chisels



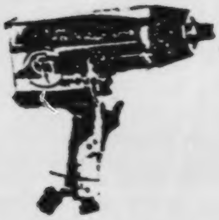
Allen Wrenches



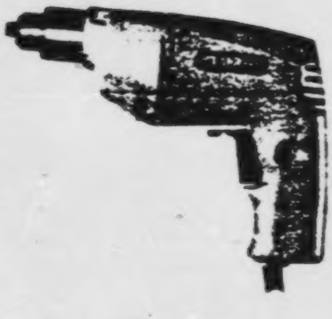
Wheel Pullers



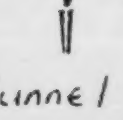
Welding Gloves



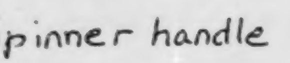
Air Wrench



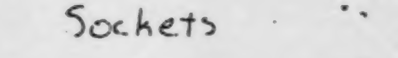
Power Drill



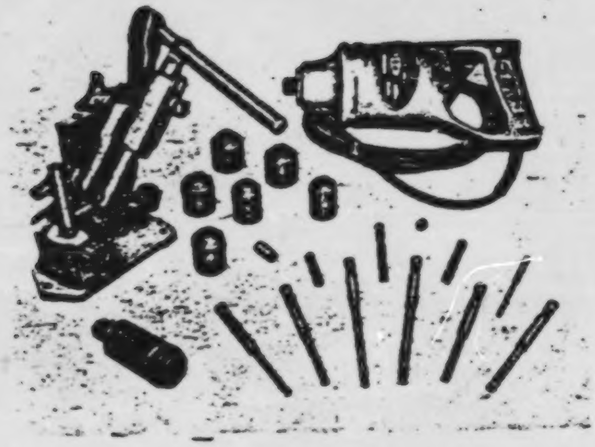
Funnel



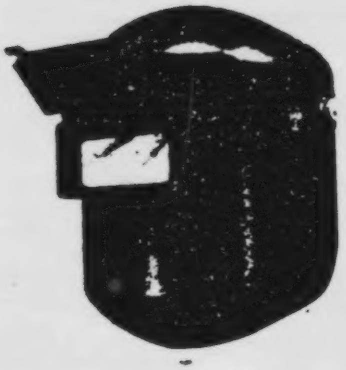
Spinner handle



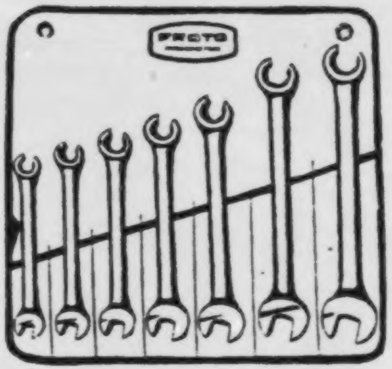
Sockets



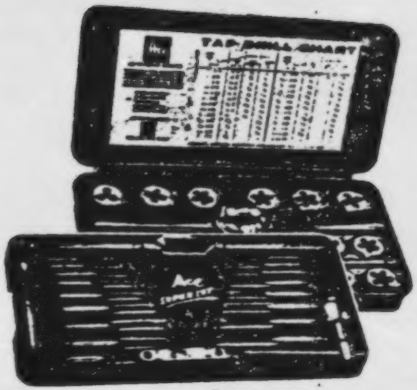
Value Seat Grinder



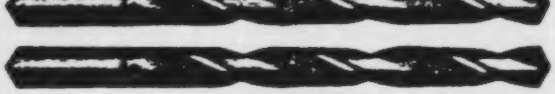
Welding Helmet



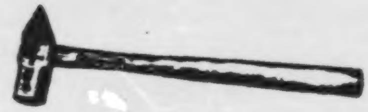
Combination Flare Nut Wrenches


TAP-DRILL CHART
Ace

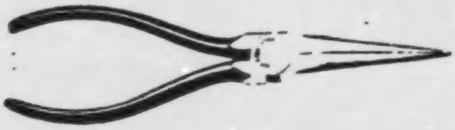
Tap & Die Set



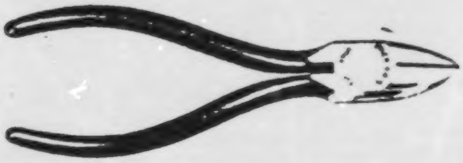
Drills



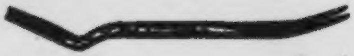
Blacksmith Hammer



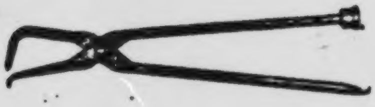
Needle Nose Pliers



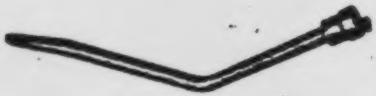
Wire Cutting Pliers



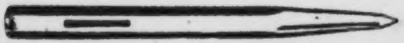
Brake Adjusting Tool



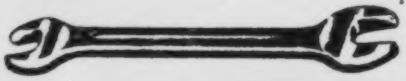
Brake Spring Pliers



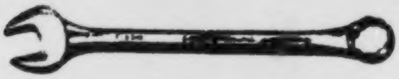
Brake Spring Tool



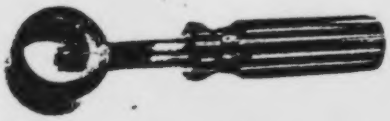
Prick Punch



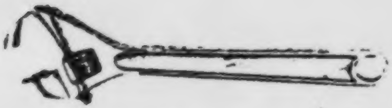
Open End Wrench



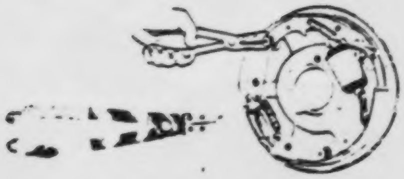
Combination Wrench



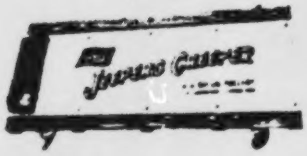
Punch and Chisel Holder



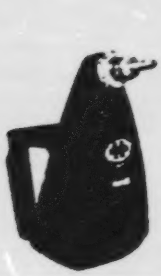
Adjustable Wrench



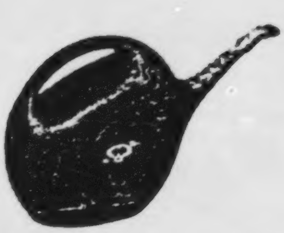
Brake Shoe Retaining
Spring Tool



Creeper



Battery Filler



Radiator Fill

EQUIPMENT AND MACHINES

(Selected List)

ARBOR PRESS

ARC WELDER

AUTOMOBILE SCOPE

BATTERY CHARGER

BEAD BREAKER

BRAKE DRUM LATHE

CENTER HUB

COMBINATION TOOL

DRILL PRESS

GAS CUTTING TOOOL

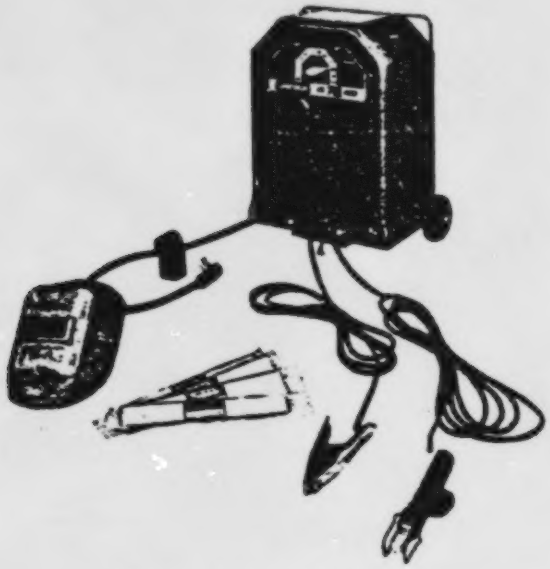
GAS WELDING TORCH

GRINDER

PARTS DEGREASER

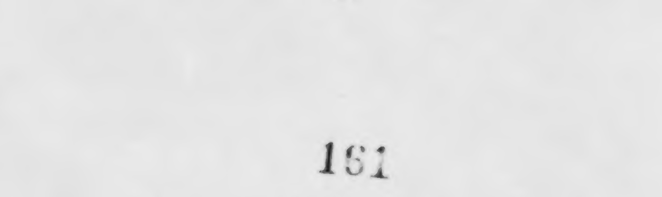
TIRE CHANGER

VALVE RECONDITIONING MACHINE

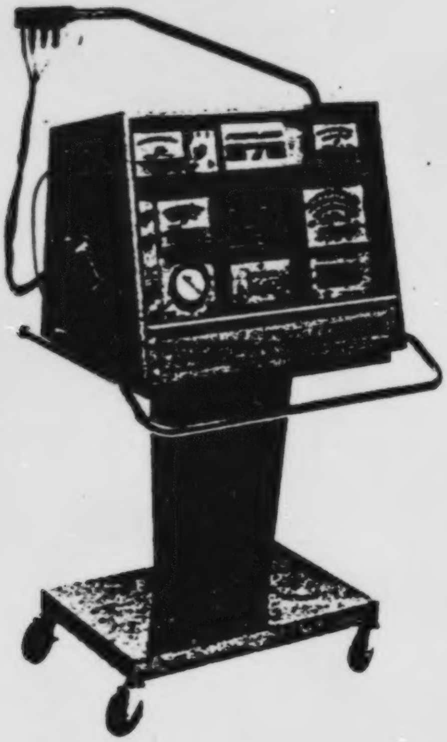


Arc Welder

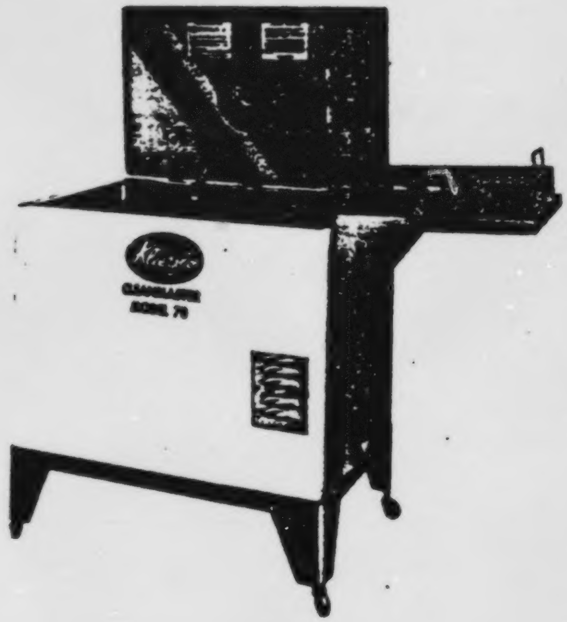
Gas Welding Torch



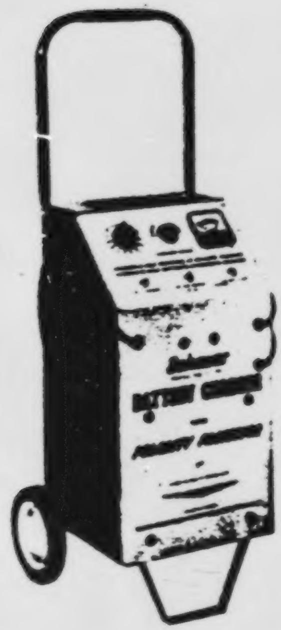
Gas Cutting Torch



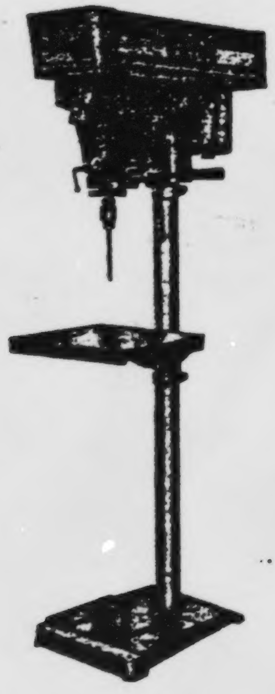
Automobile Scope



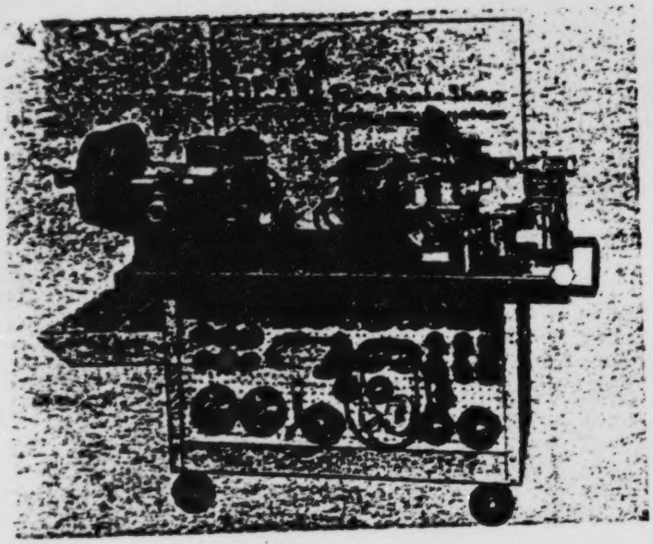
Parts Degreaser



Battery Charger

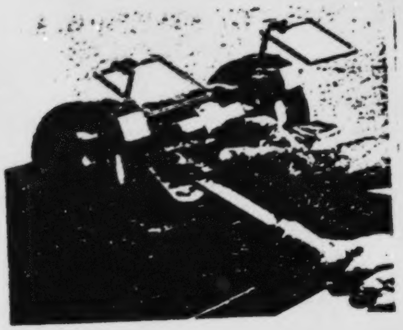


Drill Press

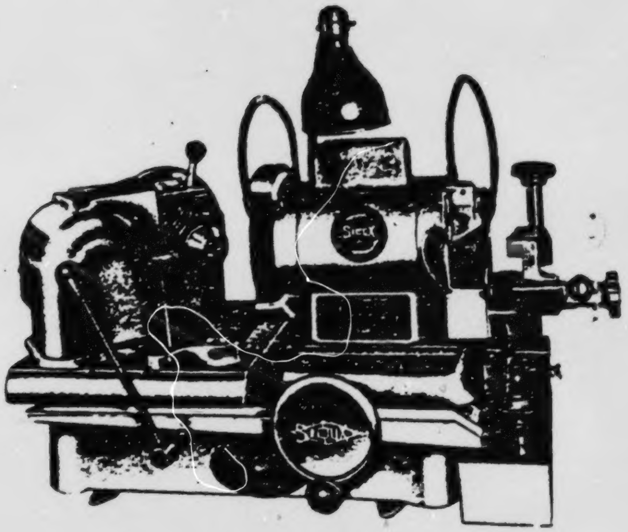


Brake Drum Lathe

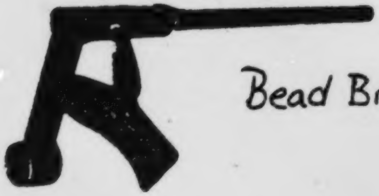
Arbor Press



Grinder

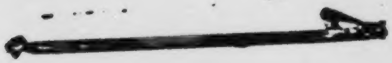


Valve Reconditioning Machine



Bead Breaker

Tire Changer



Combination Tool

Center Hub

SUPPLIES

(Selected List)

ANTIFREEZE

BRAKE FLUID

GREASE

OIL

REAR END GREASE

TRANSMISSION FLUID

ENGINES

(Selected List)

V-8 CYLINDER ENGINE

IN LINE 6 CYLINDER ENGINE

OVERHEAD CAM 6 CYLINDER ENGINE

SLANT 6 CYLINDER ENGINE

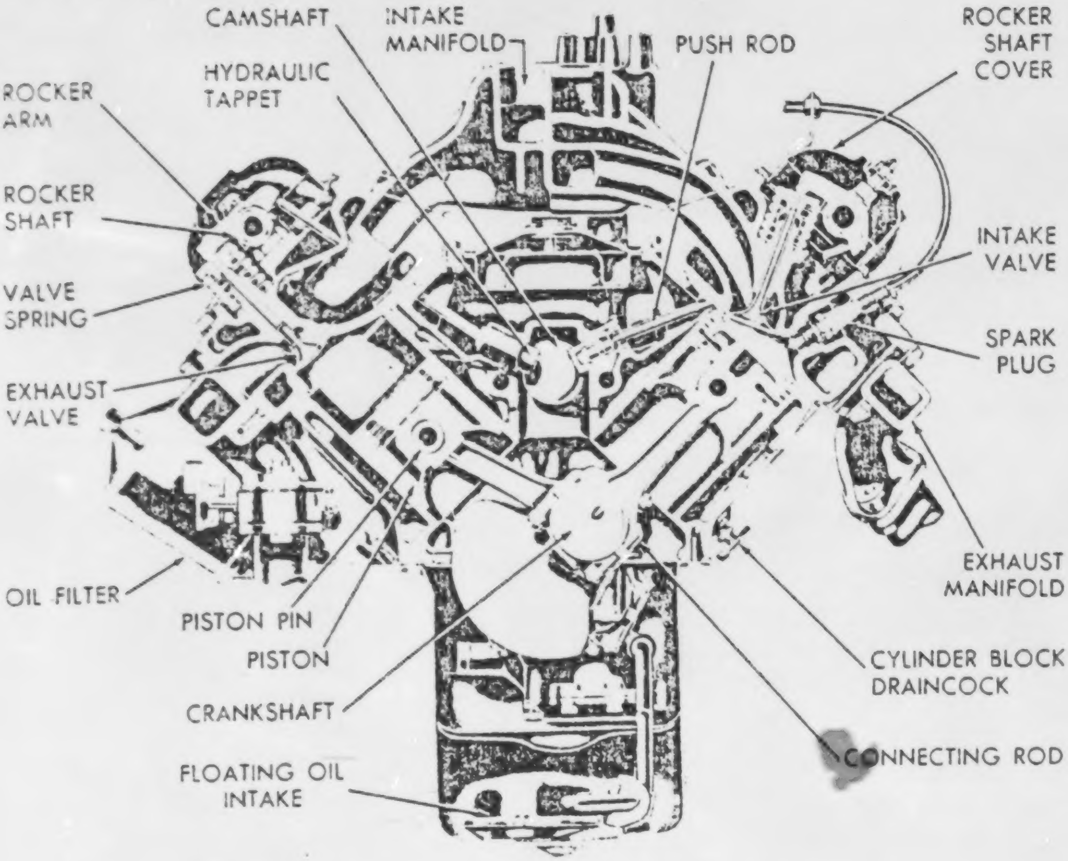

CAMSHAFT
INTAKE MANIFOLD
PUSH ROD
ROCKER SHAFT COVER
HYDRAULIC TAPPET
ROCKER ARM
ROCKER SHAFT
INTAKE VALVE
VALVE SPRING
SPARK PLUG
EXHAUST VALVE
EXHAUST MANIFOLD
OIL FILTER
PISTON PIN
PISTON
CYLINDER BLOCK DRAINCOCK
CRANKSHAFT
CONNECTING ROD
FLOATING OIL INTAKE

Fig. 12B. End Sectional View of V-8 Engine (Plymouth)

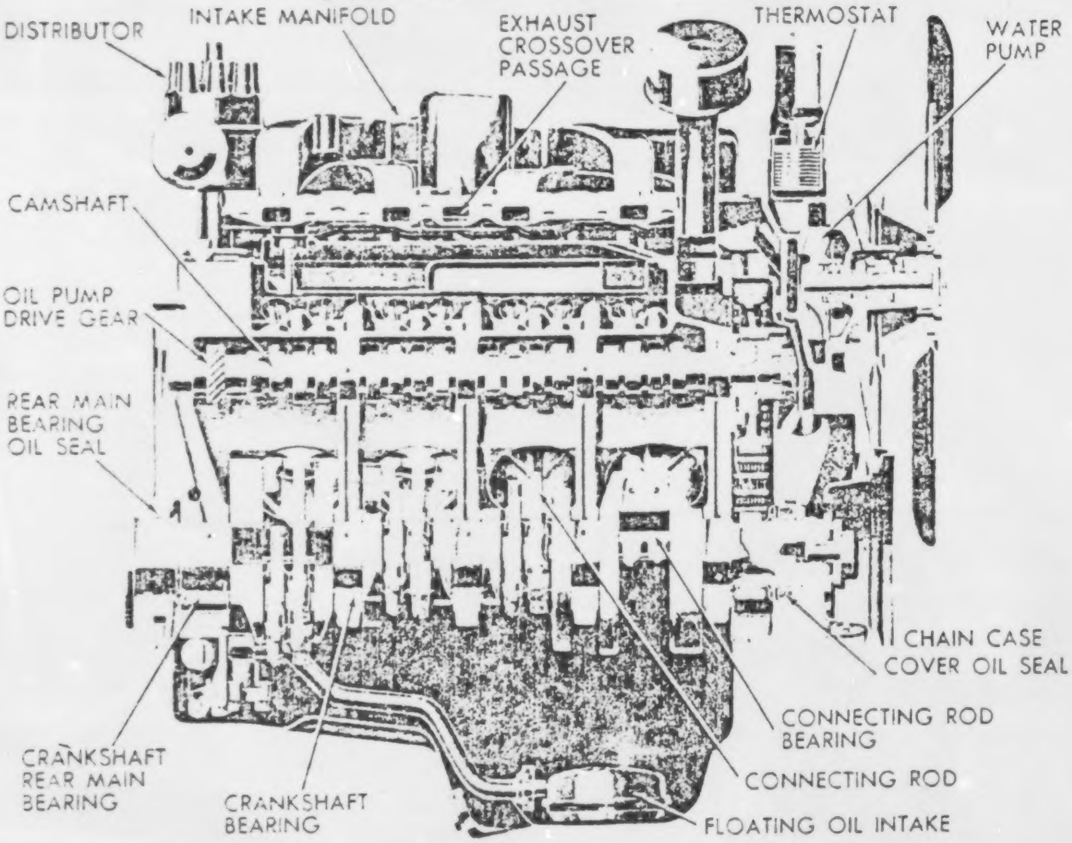
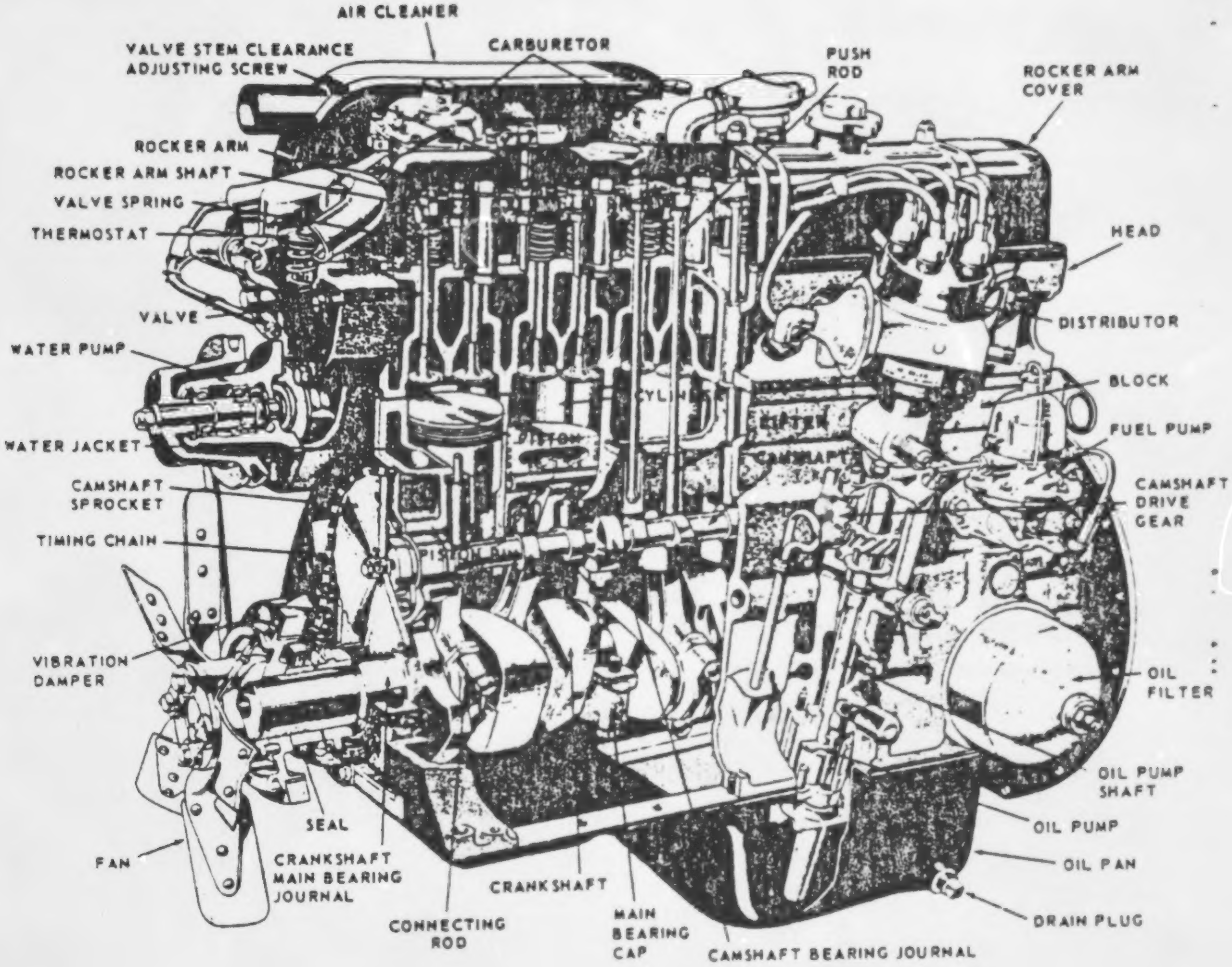
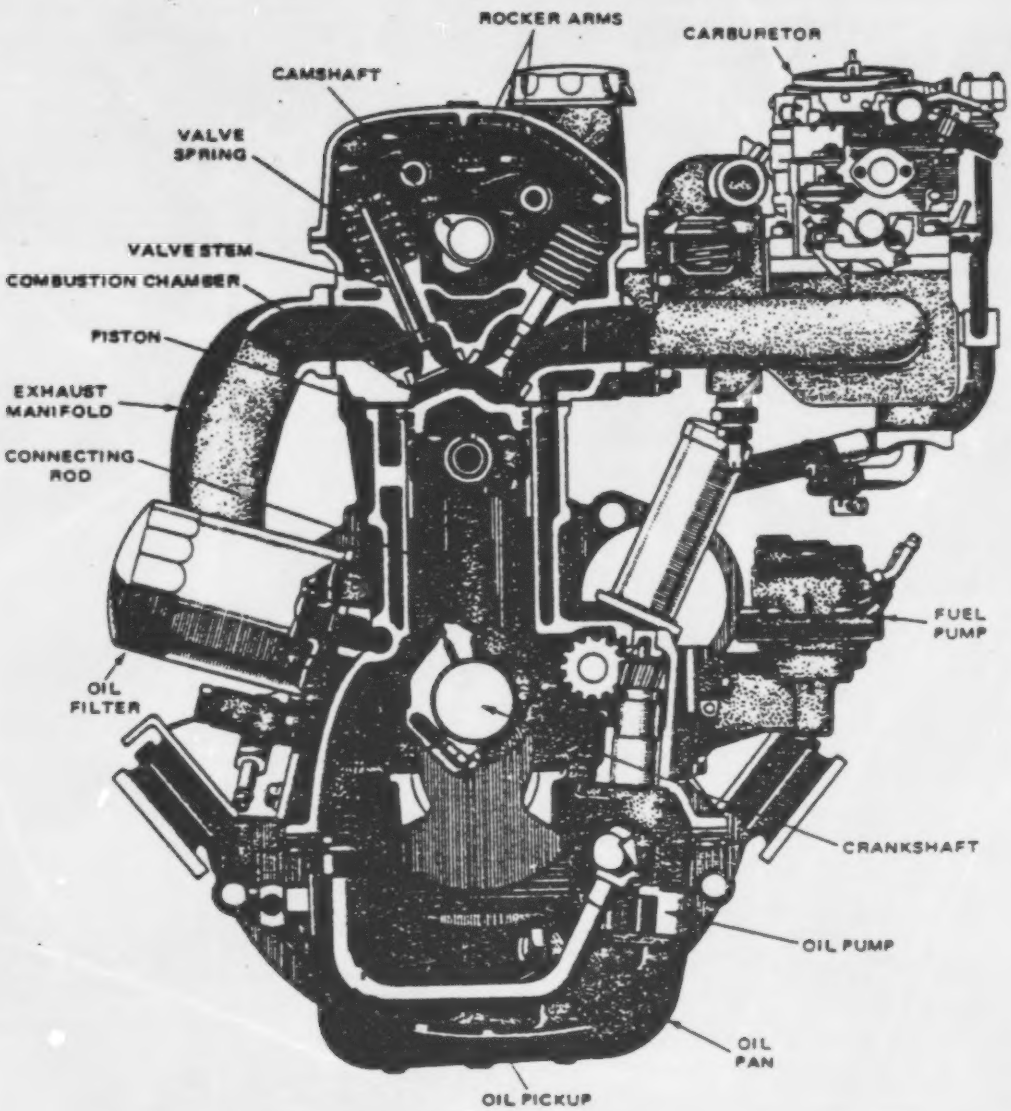

DISTRIBUTOR
INTAKE MANIFOLD
EXHAUST CROSSOVER PASSAGE
THERMOSTAT
WATER PUMP
CAMSHAFT
OIL PUMP DRIVE GEAR
REAR MAIN BEARING OIL SEAL
CHAIN CASE COVER OIL SEAL
CONNECTING ROD BEARING
CRANKSHAFT REAR MAIN BEARING
CONNECTING ROD
CRANKSHAFT BEARING
FLOATING OIL INTAKE

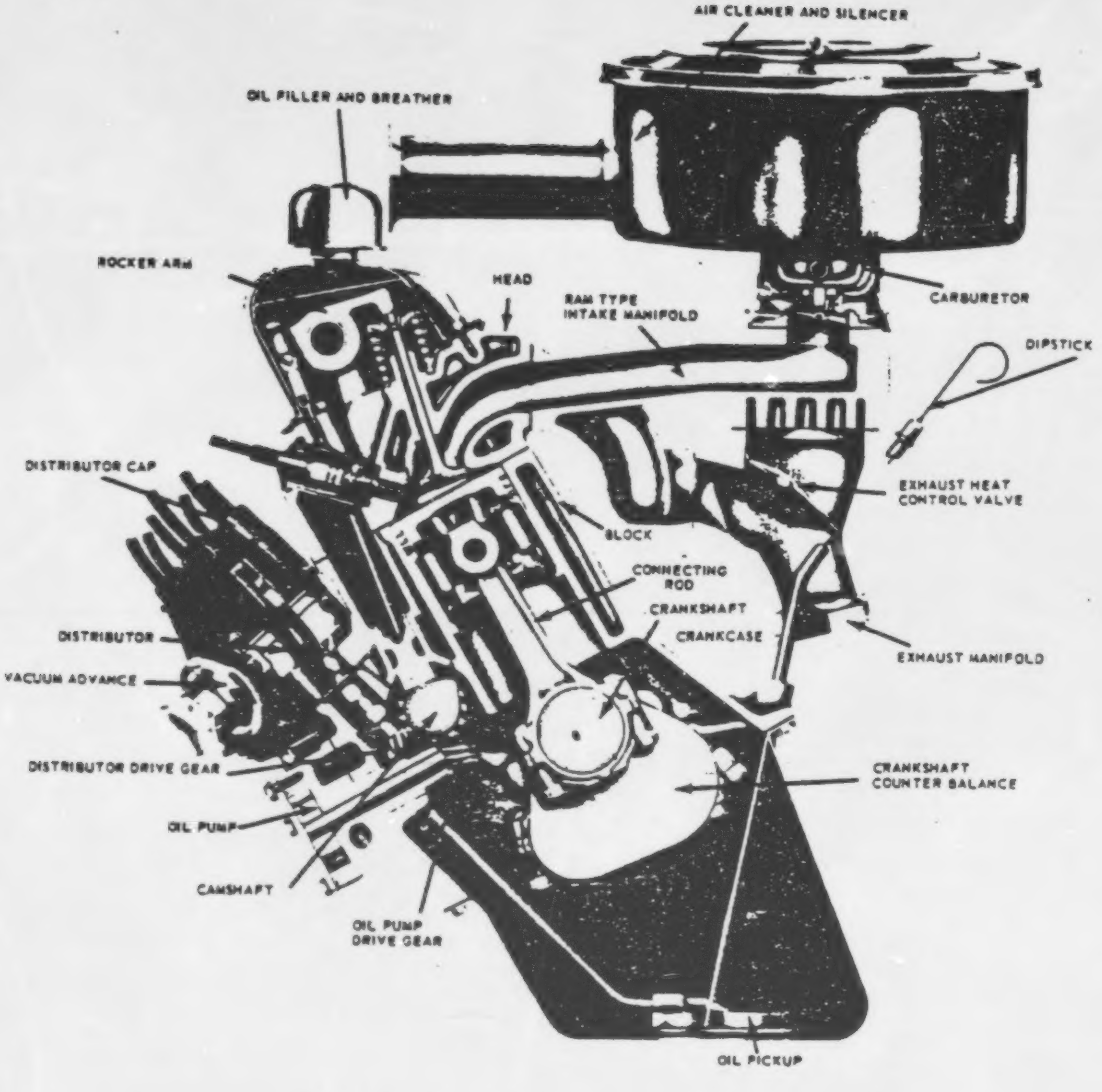
Fig. 13. Side Sectional View of V-8 Engine (Plymouth)


AIR CLEANER
VALVE STEM CLEARANCE ADJUSTING SCREW
CARBURETOR
PUSH ROD
ROCKER ARM COVER
ROCKER ARM
ROCKER ARM SHAFT
VALVE SPRING
THERMOSTAT
HEAD
VALVE
DISTRIBUTOR
WATER PUMP
BLOCK
FUEL PUMP
WATER JACKET
CAMSHAFT SPROCKET
CAMSHAFT DRIVE GEAR
TIMING CHAIN
VIBRATION DAMPER
OIL FILTER
OIL PUMP SHAFT
SEAL
OIL PUMP
FAN
CRANKSHAFT MAIN BEARING JOURNAL
OIL PAN
CRANKSHAFT
DRAIN PLUG
CONNECTING ROD
MAIN BEARING CAP
CAMSHAFT BEARING JOURNAL
PISTON
LIFTER
CAMSHAFT
PISTON PIN

In Line 6 Cylinder Engine


ROCKER ARMS
CARBURETOR
CAMSHAFT
VALVE SPRING
VALVE STEM
COMBUSTION CHAMBER
PISTON
EXHAUST MANIFOLD
CONNECTING ROD
FUEL PUMP
OIL FILTER
CRANKSHAFT
OIL PUMP
OIL PAN
OIL PICKUP

Over Head Cam 6 Cylinder
Engine


AIR CLEANER AND SILENCER
OIL FILLER AND BREATHER
ROCKER ARM
HEAD
RAM TYPE INTAKE MANIFOLD
CARBURETOR
DIPSTICK
DISTRIBUTOR CAP
EXHAUST HEAT CONTROL VALVE
BLOCK
CONNECTING ROD
CRANKSHAFT
CRANKCASE
DISTRIBUTOR
EXHAUST MANIFOLD
VACUUM ADVANCE
DISTRIBUTOR DRIVE GEAR
CRANKSHAFT COUNTER BALANCE
OIL PUMP
CAMSHAFT
OIL PUMP DRIVE GEAR
OIL PICKUP

Slant 6 Cylinder Engine

MATH SKILLS

1. WHOLE NUMBERS

   A. Addition
      - 5 digit addends with regrouping

   B. Subtraction
      - 5 digit subtrahends and minuends with regrouping

   C. Multiplication
      - 6 digit multiplicand by a 3 digit multiplier

   D. - 5 digit dividend by a 3 digit divisor

   E. Place Value of Whole Numbers (5 digits) - rounding off (in various values)

2. DECIMALS

   A. identify place value to .00001

   B. addition of 1-5 digit addends with regrouping

   C. subtraction of 1-5 digit subtrahend and minuends with regrouping

   D. multiplication of 6 digit multiplicand and 2 digit multiplier

   E. multiplication of decimals with 0 in the answer

   F. division of a 5 digit dividend with decimal and 3 digit whole number divisor

   G. division of a 5 digit dividend with decimal and a 3 digit divisor with decimal

   H. division of decimals with 0 in the answer

   I. conversion of decimals to fractions

3. FRACTIONS

   A. identifies fractions

   B. conversion of fractions to decimals

   C. equivalent fractions - reducing - in higher terms

   D. conversion of a mixed number to an improper fraction

   E. addition of fractions without common denominators

   F. muliplication of fractions and mixed numbers

   G. division of fractions and mixed numbers

   H. reciprocal of a fraction

   I. knowledge and use of ratio

4. MEASUREMENT

   A. Angles

   - identify degrees in a circle and triangle
   - measuring angles with the use of protractor
   - drawing angles with the use of a protractor
   - add, subtract, angles

   B. Metrics

   meter = 1 unit

   decameter = 10 meters

   hectameter = 100 meters

   kilometer = 1000 meters

   decimeter = .1 meter

   centimeter = .01 meter

   millimeter = .001 meter

   - reading gages and meters - pressure gage, micrometer, etc.

REMEBER THESE FORMULAS

- Power

$$\frac{\text{work}}{\text{time}} \quad \text{or} \quad P = \frac{\text{force x distance}}{\text{time}} \quad (p = \frac{f \times d}{t}$$

- Horsepower (hp)

$$\frac{\text{ft x lb}}{\text{sec. x 550}}$$

- Compression Ratio

$$\frac{\text{maximum space}}{\text{minimum space}}$$

displacement = maximum space - minimum space

- Gear Ratio

$$\frac{\text{speed of A}}{\text{speed of B}} = \frac{\text{teeth of B}}{\text{teeth of A}}$$

or the reciprocal of the ratio of number of teeth

- Transmission Ratio

$$\frac{\text{engine speed}}{\text{driver shaft speed}}$$

- Rear Axle Ratio

$$\frac{\text{driver shaft speed}}{\text{rear axle speed}} \quad \text{or} \quad \frac{\text{teeth in ring gear}}{\text{teeth in pinion gear}}$$

MATH VOCABULARY

NUMERATOR

DENOMINATOR

RATIO

PROTRACTOR

RECIPROCAL

DEGREE

METRIC MEASURES

TRIANGLE

CIRCLE

PRETEST

5271 +2318	62815 +13162	18188 +51769
6387 -5114	78854 -32513	58132 -20159
52413 x 65	45615 x 172	39145 x 258
12) 192	75) 2025	131) 11220

Round Off The Following Numbers:

598 - to the nearest hundreth ________

1211 - to the nearest tenth ________

6789 - to the nearest thousandth ________

Identify In Written Form:

.025 ________

.0001 ________

.6310 ________

.1234 +.5171	.35917 +.18570	.8496 -.5250	.6527 -.2591

$$\begin{array}{r} .5101 \\ \underline{\times\ .25} \end{array} \qquad \begin{array}{r} .6458 \\ \underline{\times\ 7.7} \end{array}$$

$15\overline{).2085}$ $\qquad 5.1\overline{)18.87}$ $\qquad .67\overline{)121.94}$

Circle Which Is Larger:

.60 or .16

.457 or .391

.0055 or .0150

Change These Fractions To Decimals:

1/2 = ________ 3/4 = ________ 5-1/6 = ________

Change These Decimals To Fractions:

.15 = ________ .625 = ________ .750 = ________

Reduce To Lowest Terms

$\frac{5}{15} =$ ____ $\qquad \frac{16}{20} =$ ____ $\qquad \frac{32}{80} =$ ____

Compute Into Higher Terms:

$\frac{1}{2} = \frac{\quad}{4} \qquad \frac{5}{8} = \frac{\quad}{16} \qquad \frac{3}{16} = \frac{\quad}{32}$

Change These Mixed Numbers To Improper Fractions:

2 1/4 = ________ 5 3/16 = ________ 8 3/8 = ________

Add These Fractions And Reduce To Lowest Terms:

1/2 + 1/2 = __________ 2 3/8 + 1 1/4 = __________

Give The Reciprical Of These Fractions:

3/8 __________ 5/32 __________

Multiply These Fractions:

1/2 x 7/16 = __________ 1 3/8 x 2 3/4 = __________

Divide These Fractions:

5/8 ÷ 1/4 = __________ 4 3/16 ÷ 1 1/8 = __________

How many degrees in a circle ? __________

How many degrees in a triangle? __________

Using The Metric System:

meter = 1 unit
decameter = 10 meters
hectometer = 100 meters
kilometer = 1000 meters

decimeter = .1 meter
centimeter = .01 meter
millimeter = .001 meter

Convert The Following:

2 meters = __________ decameters
5 decameters = __________ kilometers
1 centimeter = __________ millimeters

Gear a has 32 teeth. Gear B has 72 teeth. What is the ratio of gear A to gear B? __________

Gear A has 60 teeth. Gear B has 35 teeth. What is the ratio of gear A to gear B? __________

RELATED TEACHING AIDS

Filmstrip and Cassettes Sets

DCA Educational Products; Warrington, Pennsylvania, 1981.

Small Engine Know How

Unit 1: Small Engine Systems
  - A. Basic Principles
  - B. The Mechanical System
  - C. Lubrication and Cooling

Unit 2: Fuel System, Ignition, Troubleshooting
  - A. The Fuel System
  - B. The Ignition System
  - C. Troubleshooting the Small Engine

Unit 3: Routine Maintenance
  - A. Preventative Maintenance
  - B. Tune Up Ignition
  - C. Tune Up Fuel

Unit 4: Major Overhaul
  - A. Disassembly and Cleaning
  - B. Inspection and Servicing
  - C. Reassembly and Starting

Pictotexts - Pictostrips (DCA)

- Car Care, Series 1
    - Battery Maintenance
    - Draining the Cooling System
    - Refilling the Cooling System
    - The Air Cleaner
    - Replacing Hoses
    - Jacks and Ramps
    - Tire Maintenance
    - Fluid Level Maintenance
    - Changing the Oil and Filter
    - Replacing Belts
- Car Care, Series 2
    - Jump Starting
    - Battery Posts and Terminals
    - Bulbs and Fuses
    - Windshield Wipers
    - Spark Plugs
    - The PCV System
    - Hydraulic Lifts
    - Fuel Filters
    - Thermostats
    - Shock Absorbers

Overhead Transparencies (DCA)

1. Auto Shop Safety
2. Automotive Hand Tools
3. Automotive Mechanics

Vocational Filmstrips

1. The Library of Career Counseling Filmstrips; Counselor Films, Inc.; Career Future, Inc.; Philadelphia, Pennsylvania.

   Set 1 #1 The World of Work

   Set 5 #3 Is a Career in Motor Vehicle or Equipment Manufacturing For You?

2. Career Exploration Series; ATC Publishers; Kankakee, Illinois.

   #404 Automotive Repair

   #403 Repair and Maintenance

RELATED OCCUPATIONAL OPPORTUNITIES

Automotive Maintenance and Repair

A. Mechanic - light repair
B. Mechanic - heavy repair
C. Cleaning
D. Lubrication

Specialized Areas

A. Tune Up Specialist
B. Diagnostic Technician
C. Parts Specialists
D. Brake Specialist
E. Transmission Specialist
F. Front End Specialist
G. Electrical Specialist
H. Air Conditioning Specialist
I. Body and Fender Specialist

Sales

A. New Cars
B. Used Cars
C. Parts and Accessories
D. Car Deliveries

Other Occupations Related to Power

A. Heating and Air Conditioning Serviceman

B. Major Appliance Repairman

C. Small Engine Repairman

D. Motorcycle Repairman

Manufacturing

Production of cars, motorcycles, airplanes, boats and other mechanical items.

SKILLS CHECKLIST

POWER MECHANICS

		EXCELLENT ABILITY	MODERATE ABILITY	LIMITED ABILITY
POSITION	stand *			
	sit			
	lie *			
	bend forward *			
GROSS MOTOR	walk *			
	push *			
	pull *			
	carry *			
	lift (50 lb.) *			
	limb flexibility *			
	hand-foot coordination *			
FINE MOTOR	eye-hand coordination *			
	hand-finger mobility *			
	eye-foot coordination *			
TACTILE	discrimination			
VISUAL SKILLS	visual acuity *			
	color vision			
	peripheral vision *			
	memory *			
	discrimination *			
	figure ground			
	depth perception			
	spatial orientation			
	directionality *			
AUDITORY SKILLS	hearing acuity *			
	memory *			
	discrimination *			
	figure ground (background noise) *			
LANG. & COMMUN.	following directions *			
	talk above background noise *			
SOCIAL	cooperation with instructor *			
	cooperation with peers *			
	working in a group situation *			
BEHAVIOR	attendance *			
	conduct *			
	attitude *			
	attention span *			
	respect for property *			
OTHER SKILLS				

WOODWORKING

Wood is one of the most common materials known to man. Recent developments in woodworking and related technology make it a rich content area for the study of modern industry. This area covers such typical activities as hand woodworking, machine processes, furniture repair, model building, and home construction processes, and an understanding of wood and related technology are explored.

Familiarization and accurate use of hand tools and common woodworking machines are emphasized. Safety, and the development of good work habits in the care and use of tools and equipment are also stressed.

GENERAL GOALS

1. Students will develop skill through operation and use of common woodworking machines and tools.

2. Students will gain insight into the basic elements of carpentry, cabinet-making and joinery; develop desirable work habits, and the ability to judge and select wood, wood products and woodworking tools.

3. Students will take an active part in planning their work, figuring costs, detailing and laying out their work, and finally completing project.

AREAS COVERED IN WOODWORKING

PLANNING - sketches, methods of construction, estimated costs.

FORMING - laying out, measuring and marking, use of hand tools and machines.

ASSEMBLING - use of fastening devices, adhesives, general construction.

FINISHING - selection of finish, use of abrasives, completion.

SAFETY PROCEDURES

1. Notify instructor immediately when injured.
2. Students must wear the proper safety garments at all times which includes safety glasses, lab aprons, and gloves when applicable.
3. There is to be no fooling around or horseplay in the shop at any time.
4. Never use any equipment in the shop unless you have been instructed in its proper use and care.
5. Never use any damaged or dull equipment.
6. Never leave a machine running when you are not there to operate it.
7. Never try to stop a machine with your hands.
8. When operating any type of machine, all loose clothing, rings, watches and other objects shall be removed.
9. Do nocrowd around any machinery. Their should be only person standing by a machine who is the operator.
10. Do not distract a student when he is operating a machine or device.
11. Never remove a guard from a machine. It is there for a purpose.
12. Never use a file or a tool without the proper handle.
13. Never cut towards yourself with sharp edge tools -Always Away.
14. Never leave a sharp object in a vise.
15. Never leave a tool (soldering iron, etc.), or piece of material (metal) while it is hot.
16. When carrying any sharp or hot object in the shop it should be carried POINTED TO THE GROUND. Never run with any hot material or tool or sharp object.
19. Do not operate machine if instructor is out of the room.

READING

Texts Used:

1. Exploring Woodworking Fred W. Zimmerman; Goodheart Wilcox Publishers, 1976; South Holland, Illinois.

Readability Level: Approximately 10.5

Suggested Supplements:

1. The Basic Book of Woodworking Patrick E. Spielman; American Technical Society, 1979; Chicago, Illinois.

Readability Level: Approximately 4.5

2. Shop Made Easy Frank Cattaneo; Frank E. Richards Publishing, 1971; Phoenix, New York.

Readability Level: Approximately 6.5

3. You Can Be A Carpenter Arthur Liebers; Lothrop, Lee, and Shepard Company, 1973; New York, New York.

Readability Level: Approximately 6.0

4. Working With Wood herbert Horowitz; Minnesota Instructional Materials Center; White Bear Lake, Minnesota.

Readability Level: Approximately unknown

KEY WORD VOCABULARY

(Selected List)

ABRASIVES
ADHESIVE
BEVEL
BIT
BOARD FOOT
BUTT
CELL
CHAMFER
CHUCK
CLOSE GRAIN
DADO
EDGE
EPOXY
FACE
FEED
FIBER
GRIT
GROOVE
HONING
JOINT
KERF
OPEN GRAIN
PUSH STICK
PLYWOOD
ROUT
SHAPING
SHEET MATERIAL
STAINING
VENEER
WARP

WOODWORKING

DEFINITIONS

Abrasives (ə brā´sĭvz) - materials used to smooth wood or ground metal by rubbing.

Adhesive (ăd hē´sĭv) - bonding material or glue used to join pieces of wood together.

Bevel (bĕv´əl) - a round cut edge.

Bit (bĭt) - refers to cutting tools used for drilling and routing.

Board Foot (bord fo͝ot) - one hundred forty four cubic inches of a board.

Butt (bŭt) - simplest of right angle joints.

Cell (sĕll) - a wood fiber.

Chamfer (chăm´fer) - the rounding off of an edge.

Chuck (chŭk) - part of a drill or jig saw that holds the cutting tool or blade.

Close Grain (klōz grān) - woods with very fine fibers or cells.

Dado (dā´dō) - a slot wider than a saw cut that is made across the grain.

Edge (ĕdj) - one of three surfaces of a board.

Epoxy (ə pŏx´ ē) - type of glue consisted of two parts that must be mixed. This glue is waterproof and cannot be remixed.

Face (fāc) - usually the largest of the three surfaces of a board.

Feed (fēd) - refers to direction for advancing a tool to the wood or the wood into a machine.

Fiber (fī´ber) - the fine tube-like structure of wood which determines the grain direction.

Grit (grĭt) - coarseness or smoothness of sandpaper or abrasives.

Groove (gro͞ov) - a slot wider than a saw cut made parallel to the grain.

DEFINITIONS CONTINUED

Honing (hōn′ing) - final process of sharpening a bevel-edge tool.

Joint (joint) - the fitting together of two or more pieces of woods.

Kerf (kerf) - path cut by a saw.

Open Grain (ō′pĕn grān) - refers to the kinds of wood with larger pores or cells.

Push Stick (po͝osh stĭk) - safety device used to feed wood into machines.

Plywood (plī′wo͝od) - sheet material made by gluing thin layers of wood together.

Rout (rout) - cutting bits used for finishing edges.

Sanding (sănd′ing) - smoothing an object.

Shaping (shāp′ ing) - cutting, forming, and molding of wood.

Sheet Material (shēt mə tear′ ē əl) - any wood or plastic materials made in flat panals.

Staining (stā′ ning) - applying a color or tone into wood's grain.

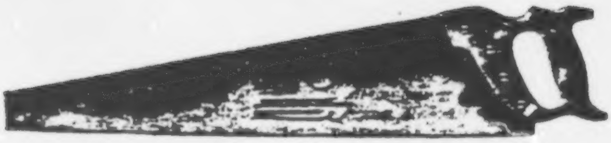
Veneer (vĕn ear′) - thin slices or sheets of wood.

Warp (worp) - twisted or bowed wood.

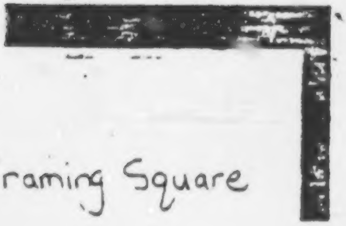
TOOLS

(Selected List)

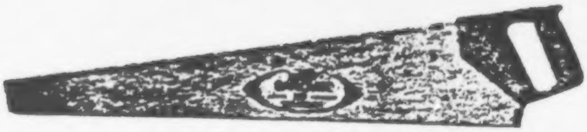
AUGER BIT
AWL
BACK SAW
BAR CLAMP
BELT SANDER
BENCH PLANE
BRACE
C —CLAMP
COMBINATION SQUARE
COMPASS
COMPASS SAW
COPING SAW
CROSS CUT SAW
DOVETAIL SAW
FILES
FORSTNER BIT
FRAMING SQUARE
HAMMER
HAND DRILL
JIG SAW
LEVEL
MARKING GAUGE
MEASURING TAPE
MITER BOX
MITER SAW
NAIL SET
PAINT BOX
PARALLEL CLAMPS
PHILIPS HEAD SCREWDRIVER
PLIERS
PLUMB BOB
POWER HAND DRILL
RABBET PLANE
RASPS
RIP SAW
ROUTER
SCRAPER
SCREWDRIVER
SHAVER
SKILSAW
TRY SQUARE
VIBRATING SANDER
WOOD CHISEL



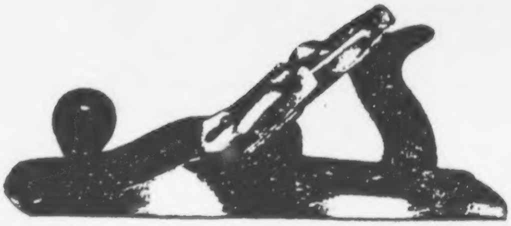
Rip Saw



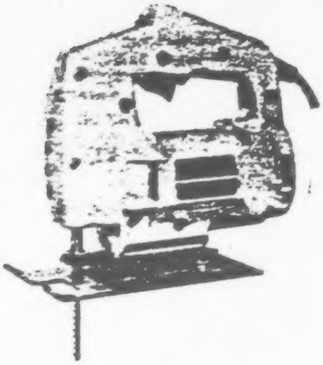
Framing Square



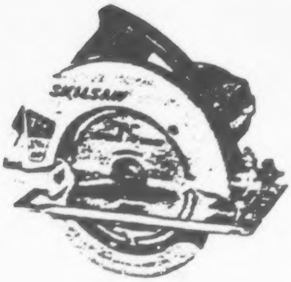
Cross Cut Saw



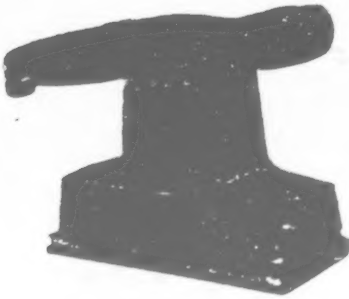
Bench Plane



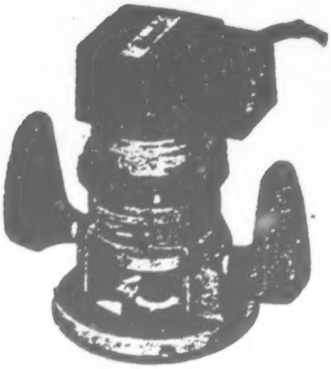
Jig Saw



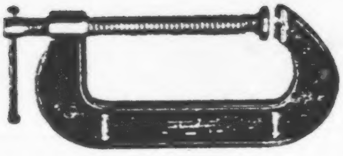
Skilsaw



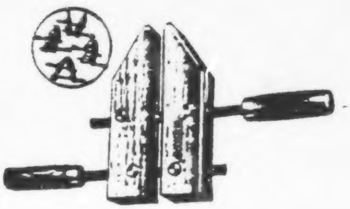
Vibrating Sander



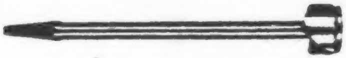
Router



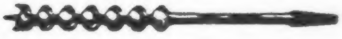
C-Clamp



Parallel Clamps

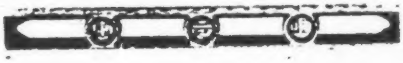


Forstner Bit

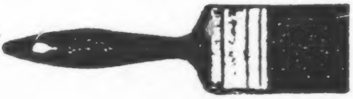


Auger Bit

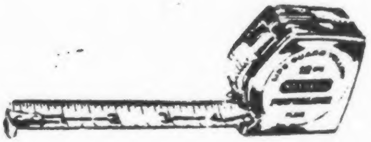
Nail Set



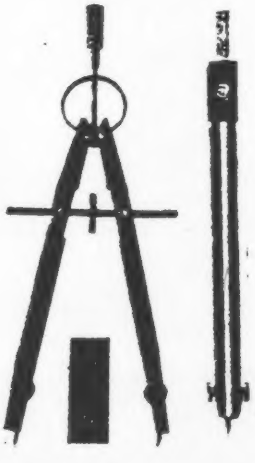
Level



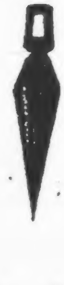
Paint Brush



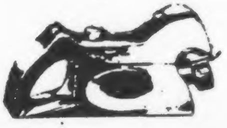
Measuring Tape



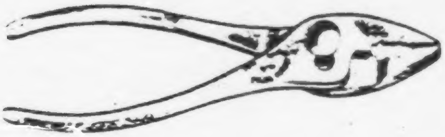
Compass



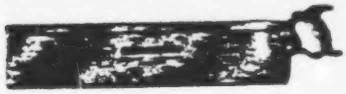
Plumb Bob



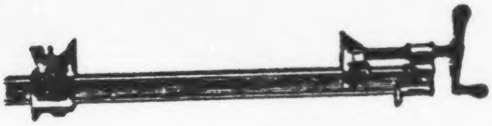
Rabbet Plane



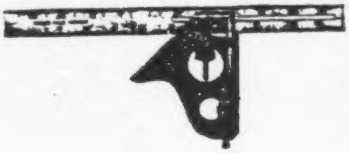
Pliers



Miter Saw

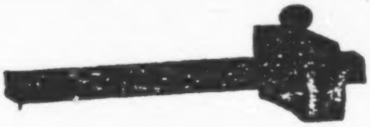


Bar Clamp

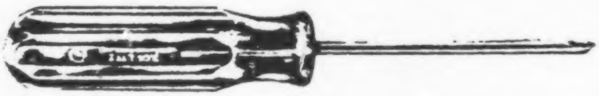


Combination Square

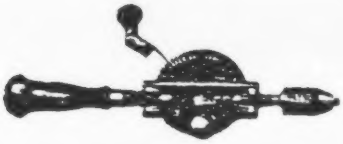
Files



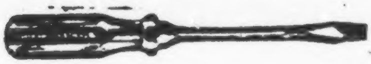
Marking Gage



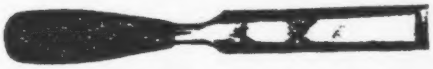
Philips Head Screwdriver



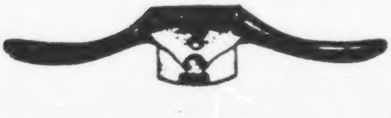
Hand Drill



Screwdriver



Wood Chisel.



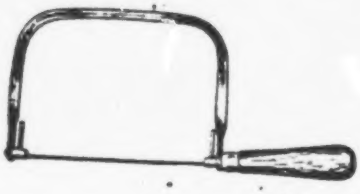
Scraper

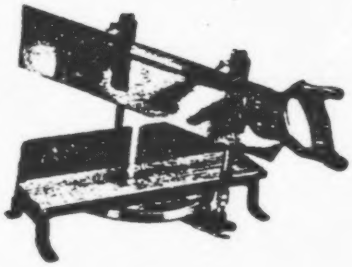
Shaver

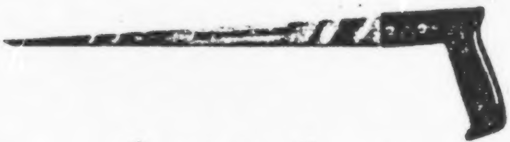
Back Saw

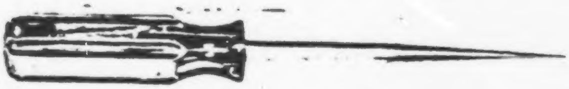
Hammer

Brace

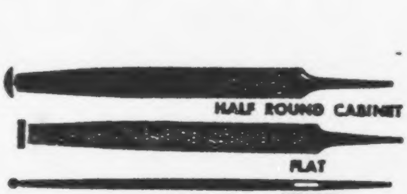

Coping Saw

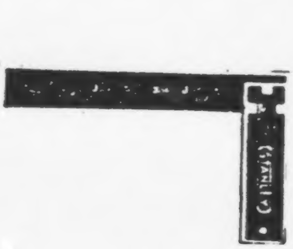

Miter Box


Compass Saw

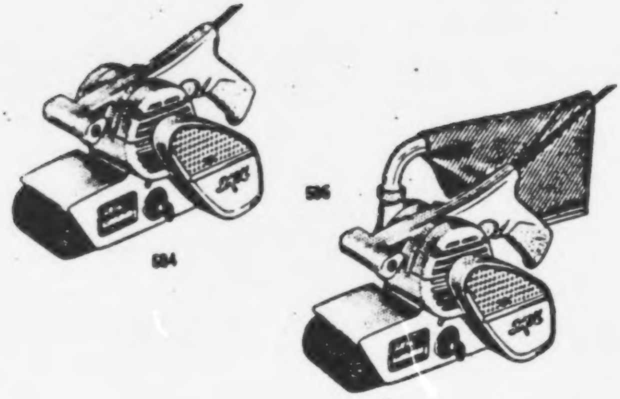

Awl

Dovetail Saw

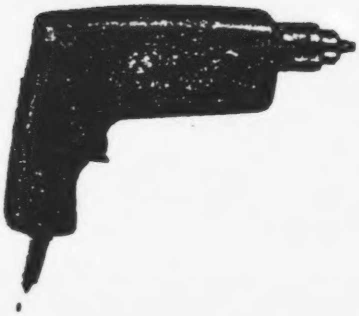

HALF ROUND CABINET
FLAT
ROUND
Rasps



Try Square



Belt Sander



Power Hand Drill

EQUIPMENT AND MACHINES

(Selected List)

BAND SAW

BELT AND DISC FINISHING SANDER

JOINTER

PLANER

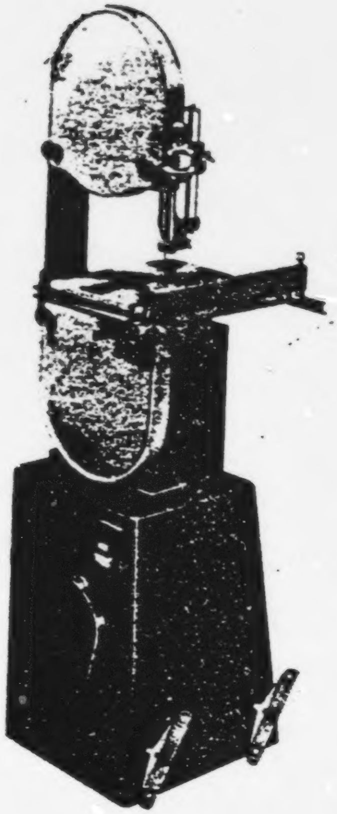
RADIAL

SCROLL SAW

TABLE SAW

WOODWORKING BENCH

WOOD LATHE



Band Saw

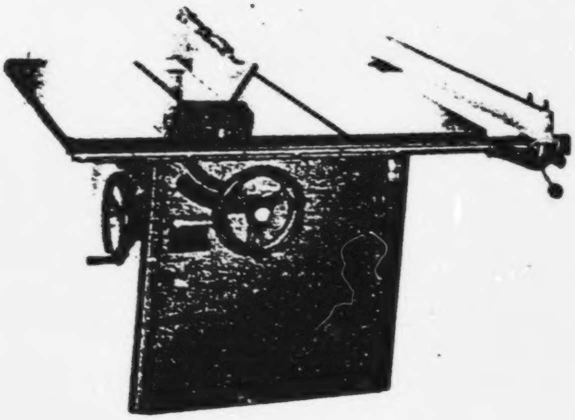
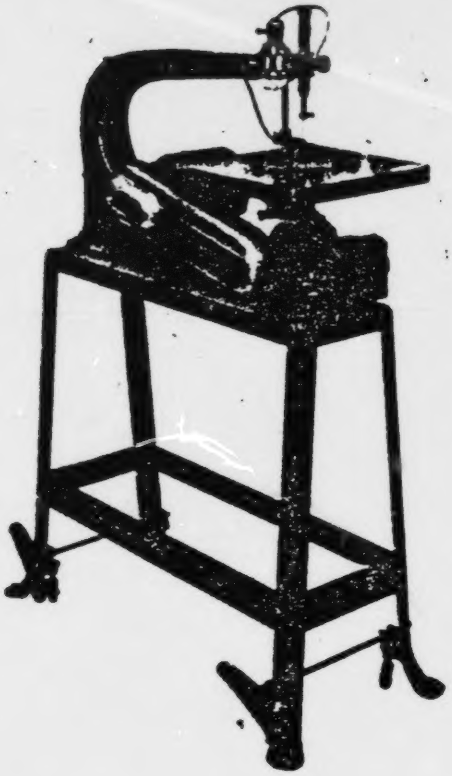
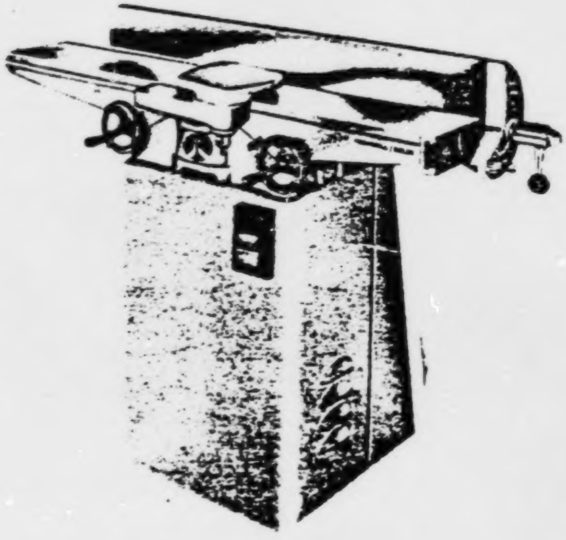


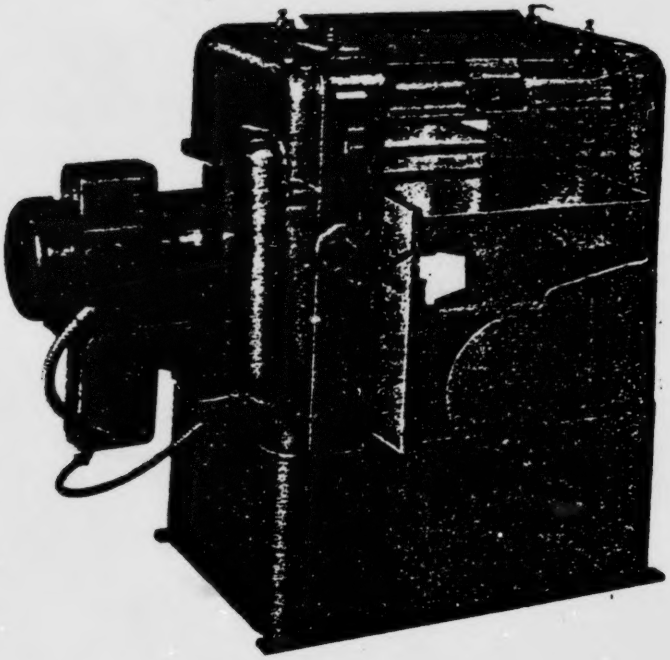
Table Saw



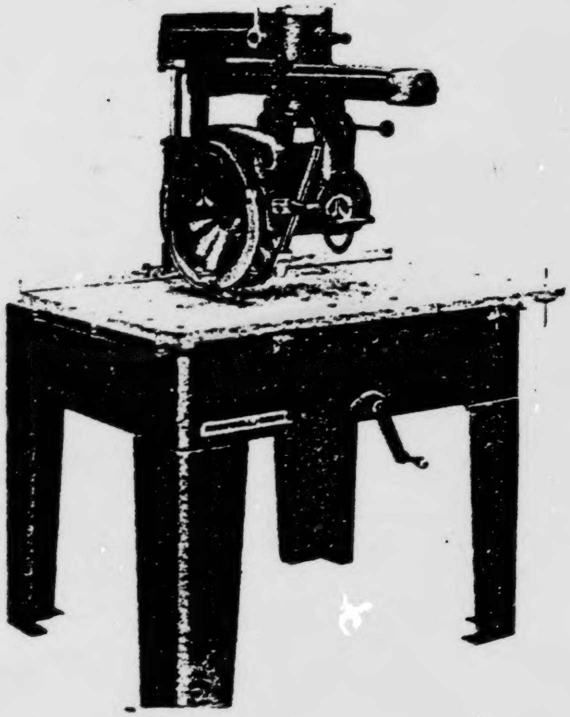
Scroll Saw



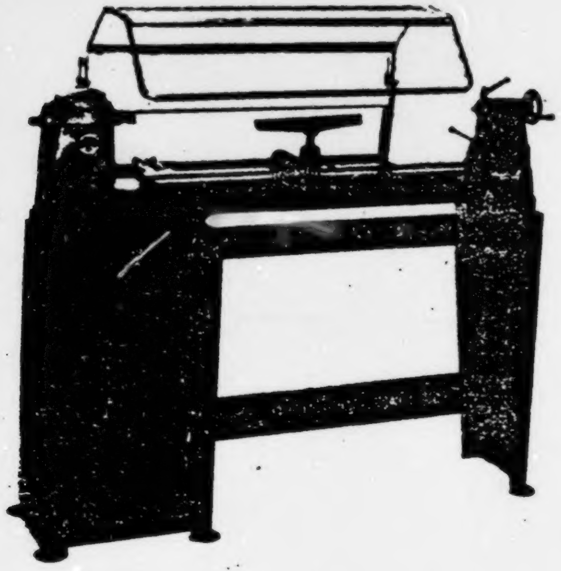
Jointer



Planer

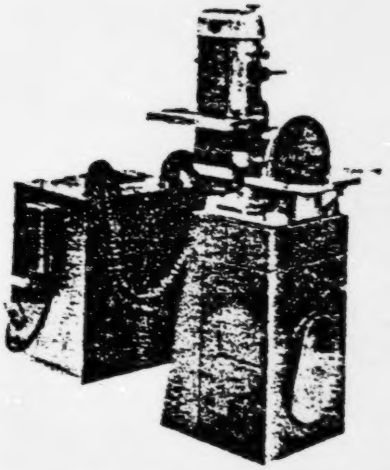


Radial Saw



Wood Lathe

Woodworking Bench



Belt & Disc Finishing Sander

MATH SKILLS

1. WHOLE NUMBERS

A. Addition
   - 3 digit addend with regrouping

B. Subtraction
   - 3 digit subtrahend and minuend

C. Multiplication
   - 3 digit multiplicand by a 3 digit multiplier

D. Division
   - 3 digit dividend by a 2 digit divisor

2. FRACTIONS

A. identifies fractions

B. equivalent fractions - reducing and in highest terms

C. conversion of mixed numbers to an improper fraction and vise versa

D. addition of fractions

E. subtraction of fractions

F. multiplication of fractions

G. division of fractions

3. MEASUREMENT

A. measurement to the inch, 1/2 inch, 1/4 inch, 1/8 inch, 1/16 inch

B. conversion of feet to inches and inches to feet

4. ANGLES

A. identify angles in degrees

MATH VOCABULARY

length
width
height
depth
inch
feet
denominator
numerator
diameter
radius
angle
degrees

PRETEST

$$\begin{array}{rrrr} 291 \qquad & 326 \qquad & 585 \qquad & 622 \\ \underline{+508} \qquad & \underline{+481} \qquad & \underline{+397} \qquad & \underline{+798} \end{array}$$

$$\begin{array}{rrrr} 788 \qquad & 981 \qquad & 382 \qquad & 700 \\ \underline{-457} \qquad & \underline{-521} \qquad & \underline{-195} \qquad & \underline{-546} \end{array}$$

$$\begin{array}{rrrr} 80 \qquad & 38 \qquad & 326 \qquad & 617 \\ \underline{x5} \qquad & \underline{x27} \qquad & \underline{x58} \qquad & \underline{x149} \end{array}$$

$$3\overline{)\,81} \qquad 5\overline{)\,95} \qquad 28\overline{)\,140} \qquad 12\overline{)\,230}$$

Reduce these fractions to lowest terms:

4/8 = ______ 14/16 = ______ 16/16 = ______

6/32 = ______ 8/32 = ______ 2/8 = ______

$$\frac{1}{4} = \frac{\_\_}{16} \qquad \frac{3}{8} = \frac{\_\_}{16} \qquad \frac{7}{16} = \frac{\_\_}{32}$$

Change these mixed numbers to improper fractions:

5 1/2 = _____ 2 7/16 = _____ 9 9/32 = _____

Circle which is larger?

4' or 4 1/2'   3 1/2' or 3' 5/8"   3/16" or 5/32"

Add these fractions and reduce to lowest terms:

5/8 + 1/8 = _____   2 3/8 + 1/8 = _____   1 3/4 + 5/16 = _____

Multiply these fractions and reduce to lowest terms:

1/2 x 1/4 = _____   3 1/2 x 2 1/2 = _____   2 7/16 x 5/8 = _____

Subtract these fractions and reduce to lowest terms:

3/4 - 1/4 = _____   1 5/8 - 3/8 = _____   5 1/2 - 3/4 = _____

Divide these fractions and reduce to lowest terms:

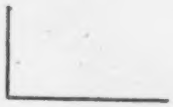
3/4 ÷ 5/16 = _____   5 3/8 ÷ 3 5/8 = _____   7 1/2 ÷ 2 9/32 = _____

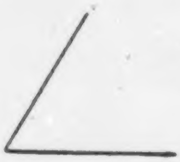
Convert the following:

2 1/2 feet = ______ inches   18 inches = ______ feet

36 inches = ______ feet or ______ yard (s)

Identify these angles: (use protractor if needed)





In the following dimensions 2" x 4" x 8' identify which is the length, width, and the height.

2" = ______ 4" = ______ 8' = ______

A 1/2" drill has a __________ radius.

A 1 inch hole has a __________ diameter.

A circle has __________ degrees.

RELATED TEACHING AIDS

Filmstrips and Cassette Sets

1. DCA Educational Products, Washington, Pennsylvania
   Millwork Machines

   Unit 1 - The Tilting Arbor Table Saw

      A. Introduction
      B. Basic Operations
      C. Special Operations

   Unit 2 - The Jointer and Planer

      A. Introduction
      B. Set Up
      C. Operations

   Unit 3 - The Radial Arm Saw

      A. Introduction
      B. Set Up
      C. Operations

   More Millwork Machines

   Unit 1 - Sanding Machines

      A. The Belt Sander
      B. The Belt Sander and Disc Sander
      C. The Spindle Sander

   Unit 2 - The Band Saw and the Scroll Saw

      A. Band Saw - Set-Up
      B. Band Saw Operation
      C. Scroll Saw

Unit 3 - The Drill Press and Hollow Chisel Mortiser

A. The Drill Press Introduction and Cutting Tools

B. The Drill Press Precision Boring

C. The Hollow Chisel Mortiser

Overheads and Transparencies (DCA)

1. Woodworking Basics

   Group 1 - Safety in the Woodshop

   Group 2 - Cutting Tool Details

   Group 3 - Squaring and Building Up Stock

   Group 4 - Adhesives and Gluing

   Group 5 - Joints

   Group 6 - Basic Construction Details

   Group 7 - Fasteners

   Group 8 - Smoothing and Finishing

2. Woodworking Hand Tools

Vocational Filmstrips

1. The Library of Career Counseling Filmstrips, Counselor Films Inc., Career Future Inc., Philadelphia, Pa.

   Set 1 #1 The World of Work

   Set 10 #1 Is A Career in Pulp and the Paper Industry For You?

RELATED OCCUPATIONAL OPPORTUNITIES

Construction

Framer
Trimmer
Roofer

Woodworking Craftsman

Carpenter
Cabinet Maker

Forestry

Lumberjack
Mill Worker

Manufacturing

Wood Equipment Salesman
Model Maker
Pattern Making

SKILLS CHECKLIST

WORDWORKING

		EXCELLENT ABILITY	MODERATE ABILITY	LIMITED ABILITY
POSITION	stand *			
	sit			
	lie			
	bend forward *			
GROSS MOTOR	walk *			
	push *			
	pull *			
	carry *			
	lift (50 lb.) *			
	limb flexibility *			
	hand-foot coordination			
FINE MOTOR	eye-hand coordination *			
	hand-finger mobility *			
	eye-foot coordination			
TACTILE	discrimination *			
VISUAL SKILLS	visual acuity *			
	color vision *			
	peripheral vision *			
	memory *			
	discrimination			
	figure ground			
	depth perception			
	spatial orientation			
	directionality *			
AUDITORY SKILLS	hearing acuity *			
	memory *			
	discrimination			
	figure ground (background noise) *			
LANG. & COMMUN.	following directions *			
	talk above background noise *			
SOCIAL	cooperation with instructor *			
	cooperation with peers *			
	working in a group situation *			
BEHAVIOR	attendance *			
	conduct *			
	attitude *			
	attention span *			
	respect for property *			

OTHER SKILLS

ADDITIONAL SELECTED RESOURCES FOR WORKING WITH SPECIAL NEEDS STUDENTS IN VOCATIONAL EDUCATION

TITLE: Assessment of Basic Vocational Related Skills

Assessment Modules in the Areas of:

Welding
Agriculture
Graphic Arts
Woodworking
Automotive
Autobody
Drafting
Sheet Metal
Health Occup.
World of Work
Food Preparation
Child Care

Distributive Education
Electricity
Horticulture
Business & Office Occupations

SOURCE: Vocational Teacher Education Department
University of Northern Colorado
Greeley, COLO. 80639

TITLE: Career Exploration and Preparation for the Special Needs Learner by Allen Phelps and Ronald Lutz

SOURCE: Allyn & Bacon, Inc.
460 Atlantic Avenue
Boston, MA. 02210

TITLE: Vocational Reading Skills Student Workbooks in Agriculture, Automotive, Carpentry, Electricity, Electronics, and Metals and Machines

SOURCE: Shoptalk Series
Allyn & Bacon, Inc.
470 Atlantic Avenue
Boston, MA. 02210

TITLE: Examples of vocational instructional materials which have been developed for persons with limited reading ability. -Request catalog

SOURCE: Career Related Instruction Project
Capital area career center
611 Hagadorn Road
Mason, Michigan 48854
(517) 676-3300

TITLE: Vocational Insructional Materials for Students with Special Needs
by: Wallace, S. and Towne, D.

SOURCE: Northwest Regional Educational Lab
700 Lindsay Bldg.
710 S. W. Second Avenue
Portland, Oregon 97204

TITLE: Vocational Education Resource Materials for Special Education by Lambert, R. H., Tindall, L. and others

SOURCE: Center for Studies in Voc.-Tech. Educ.
University of Wisconsin
Madison, WISCONSIN 53706

TITLE: Resource Directory for Teacher Education in Vocational Special Needs by Wentling, T. and others

SOURCE: Minnesota Research and Development Center
for Voc. Ed.
Dept. of Voc. & Technical Educ.
D12 Fraser Hall
106 Pleasent Street, S. E.
Minneapolis, MINN. 55455

TITLE: Entering the World of Work

SOURCE: McKnight Publishing Co.
P.O. Box 2854
Bloomington, ILL 61701

TITLE: Succeeding in the World of Work

SOURCE: Vocational-Technical Curriculum Laboratory
Rutgers University, Building 4103
Kilmer Campus
New Brunswick, N.J. 08903

a number of vocational publications designed for students with a low reading level are available from this organization.

Source for all of the following materials:

Minnesota Instructioal Materials Center
3300 Century Ave., North
White Bear Lake, MN. 55110

TITLE: Working With Wood

AUTHOR: Horowitz, Herbert

TITLE: Safety Practices and Procedures in School Shops

AUTHOR: Johnson, Joseph and Manchso, John

TITLE: Basic Concepts in Numerical Control

AUTHOR: Horn Roger

TITLE: Vocational Entry Skills for Learning Disabled Secondary Students

AUTHOR: Washburn, Winifred

SELECTED LIST OF TRADE SCHOOLS IN CONNECTICUT

BRIDGEPORT

Bullard Haven Regional Vocational Technical School
500 Palisades Ave,
(Automotive; Carpentry; Drafting, Achetectural & Mechanical; Machine Technology; Painting; Plumbing)

County Schools Inc.
3789 Main St.
(Drafting Technology)

DANBURY

Henry Abbot Technical School
Hayestown Ave.
(Appliance Repair; Auto Body & Fender Repair; Auto Mechanics; Carpentry; Drafting; Electricity-Master Electrician; Electronics, Industrial; Graphic Arts; Machine Tool & Die; Plumbing)

Warren Institute
321 Main St.
(Drafting- Aeronautical, Archetectural,Electrical, Mechanical; Electronics)

DANIELSON

H.H. Ellis Regional Vocational Technical School
Maple Ave.
(Drafting Technology; Electrical Technology; Electronic Technology; Machine Shop)

HAMDEN

Eli Whitney Regional Vocational Technical School
Jones Rd.
(Drafting Technology; Electrical Technology; Machine Shop)

HARTFORD

A.I. Prince Regional Vocational Technical School
500 Brookfield St.
(Drafting Technology)

Hartford Modern School Of Welding
184 Ledyard St.
(Welding Technology)

Hartford State Technical College
401 Flatbush Ave.
(Electrical Engineering Technology; Electronic Engineering Technology; Tool & Die Design)

MANCHESTER

Howell Cheney Regional Vocational Technical School
791 W. Middle Tpke.
(Drafting-Archetectural, Industrial, Technical; Drafting Technology; Electrical Technology; Electronics Technology)

MERIDEN

Horace C. Wilcox Regional Vocational Technical School
Oregon Rd.
(Air Conditioning; Auto Mechanics; Carpentry;

Drafting Technology; Electrical Technology; Electronics Technology; Graphic Arts; Machine Tool & Die; Plumbing; Sheet Metal; Welding)

MILFORD

Technical Careers Institute
80 Erna Ave.
(Automotive Technology; Heating; Refrigeration & Air Conditioning; Welding Technology)

MONROE

Colonial Technical School
183 Main St.
(Tool & Die Design)

NEW BRITIAN

E.C.Goodwin Regional Vocational Technical School
735 Slater Rd.
(Auto Mechanics)

New England Technical Institute
99 John Downey Rd.
(Industrial Electronics; Electronics Technology; Refrigeration & Air Conditioning)

NEW HAVEN

Technical Course Institute
226 Whalley Ave.
(Auto Mechanics; Heating; Refrigeration & Air Conditioning)

NORWALK

Norwalk State Technical College
181 Richards Ave.
(Electrical Engineering Technology; Electro-Mechanical Technology; Engineering Technology; Manufacturing Technology; Mechanical Technology)

NORWICH

Mohegan Community College
(Drafting And Design Technology)

ROCKY HILL

Porter School of Automotive Technology
2139 Silas Deane Hwy.
(Archetectural Design Technology; Drafting-Archetectural,Electro-Mechanical; Engineering Technology-Electronic, Archetectural, Mechanical)

STAMFORD

J.M. WRIGHT REGIONAL Vocational Technical School
Scalzi Park
(Air Conditioning;Auto Mechanics; Blue Print Reading; Brick Masonry; Carpentry; Drafting; Machine Design; Drafting Technology; Electrical Technology; Electro-Mechanical Technology; Electronics Technology; Machine Technology; Oil Heat Technology; Pipefitting; Plumbing; Printing; Refrigeration & Air Conditioning; Sheet Metal; Tool & Die Design; Welding; Welding Technology)

STRATFORD

Chester Institute For Technical Education

2945 Main St.
(Archetectural Drafting; Mechanical Drafting; Archetectural Design Technology; Electronic Engineering Technology- Archetectural, Mechanical)

TORRINGTON

Oliver Wolcott Regional Vocational Technical School
75 Oliver St.
(Mechanical Drafting; Drafting Technology; Electronicc Technology; Engineering Technology)

WATERBURY

Porter and Chester Technical Institute
Buckinham Plaza
(Drafting)

Waterbury State Technical College
1460 W. Main St.
(Manufacturing Technology; Mechanical Technology; Tool & Die Design)

W.F, Kaynor Regional Vocational Technical School
43 Tompkins St.
(Auto Mechanics; Mechanical Drafting; Electronics Technology)

WATERFORD

Connecticut Academy of Welding
130 Cross Rd.
(Welding Technology)

WEST HAVEN

Technical Careers Institute
11 Kimberly Ave.
(Appliance Repair; Auto Body & Fender Repair; Auto Mechanics; Heating; Refrigeration & Air Conditioning; Welding Technology)

WILLIMANTIC

Windham Regional Vocational Technical School
210 Birch St.
(Appliance Repair; Auto Body & Fender Repair; Auto Mechanics; Carpentry; Drafting Archetectural and Machine Design; Electrical Technology; Electronics Technology; Machine Tool & Die)

NOTE: the high schools listed, have post graduate programs

SOURCE

Occupation Education, The College Blue Book, 16th Edition; by: McMillan Information; Collier McMillan Pub.; New York, New York, 1977.

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Kessman, W., Automobile Maintenance, Reading and Language Activities. Minnesota: Instructional Materials Center.

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Liebers, A., You Can Be A Carpenter. New York: Lothrop, Lee & Shepard, 1973.

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Smith, R., Sheet Metalwork. Illinois: McKnight, 1961.

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Stockel, M., Auto Mechanics Fundamentals. Illinois: Goodheart-Wilcox, 1978.

Swerdlow, R., The Basic Book of Graphics. Illinois: The American Technical Society, 1979.

Tracy, V., Vocabulary Skills Booklets-Auto Shop New Jersey: Voc-Tech Curriculum Lab, Rutgers University.

Wallach, P., The Basic Book of Drafting. Illinois: The American Technical Society, 1979.

Walker, J., Modern Metalworking. Illinois: Goodheart-Wilcox, 1973.

Webster, J., The Basic Book of Power Mechanics. Illinois: The American Technical Society, 1979.

Williams, G., The Basic Book of Electricity. Illinois: The American Technical Society, 1979.

Zimmerman, F., Exploring Wood working. Illinois: Goodheart-Wilcox, 1976.

Additional References

Connecticut State Dept. of Education, General Guidelines For Special Ed. Programs, Bureau of Pupil Personnel and Special Educational Services, Section 10-76d 11, Sept. 1976.

Guidelines For The Waterbury Remedial/Learning Disabilities Program. Approved by the Waterbury Board of Education, 1979.

Industrial Arts High School Curriculum for the Waterbury Public School System, Waterbury, Connecticut.

Lectures

Special Education Departments:

Central Conn. State College
New Britian, Conn.

University of Hartford
West Hartford, Conn.